

SCIENCE

A WEEKLY JOURNAL DEVOTED TO THE ADVANCEMENT OF SCIENCE, PUBLISHING THE
OFFICIAL NOTICES AND PROCEEDINGS OF THE AMERICAN ASSOCIATION
FOR THE ADVANCEMENT OF SCIENCE.

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FRIDAY, FEBRUARY 27, 1903.

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MSS. intended for publication and books, etc., intended for review should be sent to the responsible editor, Professor J. McKeen Cattell, Garrison-on-Hudson, N. Y.

THE ASTRONOMICAL AND ASTROPHYSICAL SOCIETY OF AMERICA.

THE second winter meeting of this society was held in Washington, D. C., during convocation week, in affiliation with the American Association for the Advancement of Science.

On Monday, December 29, at 4 P.M., over two hundred persons assembled in the lecture room on the first floor of the Law Building of the Columbian University to hear the address of the president of the society, Professor Simon Newcomb. This address has already appeared in SCIENCE.

Three sessions of the society for the reading of papers and transaction of business were held in the Assembly Hall of the Cosmos Club, Tuesday, Wednesday and Thursday afternoons, the average attendance being about seventy-five.

Tuesday evening the annual dinner was given at Maison Raucher. Among the forty-three present were a number of ladies and, as guests, His Excellency, the Im-

perial German Ambassador; Hon. J. T. Morgan, U. S. Senate; the Assistant Secretary of State; and the Superintendent of the Naval Observatory. A most enjoyable evening was spent together, among the good things being addresses by the guests, by Professor Newcomb, and by Professor Hale.

On Wednesday afternoon the session was adjourned shortly before 4 o'clock, to enable the members of the society to attend a reception given them by the Superintendent of the Naval Observatory and Mrs. Chester. After a most pleasant social gathering for an hour or more, all present were invited to spend as much of the evening as they chose inspecting the observatory and its instrumental equipment.

At the final session resolutions were adopted tendering the thanks of the society to Captain Chester, the Superintendent of the Naval Observatory, for his courteous invitation to visit the observatory, and his kind attentions during the meeting of the society; also tendering the thanks of the society to the Cosmos Club, for the use of the club house and of all its facilities so courteously accorded to the society and its members.

During the meeting seventeen new members were elected, and the selection of a time and place for the next meeting was left open for future action by the council.

The officers elected were:

For 1903.

President—Simon Newcomb.

First Vice-President—Geo. E. Hale.

Second Vice-President—W. W. Campbell.

Treasurer—C. L. Doolittle.

For 1903-4.

Councilors, Ormond Stone, W. S. Eichelberger.

For 1903-4-5.

Secretary—Geo. C. Comstock.

PAPERS PRESENTED.

HAROLD JACOBY: 'Comparison of Astronomical Photographic Measures made with the *réseau* and without it.'

GEORGE E. HALE, FERDINAND ELLERMAN and J. A. PARKHURST: 'The Spectra of Stars of Secchi's Fourth Type.'

W. J. HUMPHREYS: 'On Certain Matters Connected with Spectroscopic Methods.'

E. B. FROST and W. S. ADAMS: 'Radial Velocities of Twenty Stars having Spectra of the Orion Type.'

E. B. FROST and W. S. ADAMS: 'New Spectroscopic Binaries.'

E. B. FROST and W. S. ADAMS: 'The Wavelengths of Rydberg's First Line of Hydrogen (λ 4866) and Others.'

W. S. ADAMS: 'The Orbit of the Spectroscopic Binary η Orionis.'

E. O. LOVETT: 'Periodic Solutions of the Problem of Four Bodies.'

E. O. LOVETT: 'On the Integrals of the Problem of n Bodies.'

G. C. COMSTOCK: 'The Masses in 85 Pegasi.'

F. W. VERY: 'Form and Structure of the Galaxy.'

S. A. MITCHELL: 'The New Gases, Neon, Krypton and Zenon in the Chromosphere.'

G. C. COMSTOCK: 'Preliminary Account of an Investigation of the Proper Motions of Faint Stars.'

SARAH F. WHITING: 'Astronomical Laboratory Work for Large Classes.'

F. W. VERY: 'An Inquiry into the Cause of the Nebulosity Around Nova Persei.'

G. W. HOUGH: 'Improvement in the Mounting of Fixed Meridian Instruments.'

J. A. PARKHURST: 'Photometric and Photographic Observations of Faint Variable Stars.'

S. C. CHANDLER: 'The Probable Value of the Aberration Constant.'

C. L. DOOLITTLE: 'Constant of Aberration from Zenith Telescope Observations, 1901-1902.'

E. F. NICHOLS and G. T. HULL: 'The Pressure of Light and its Illustration in the Construction of a Laboratory Comet's Tail.'

E. E. BARNARD: 'On the Micrometrical Triangulation of the Stars in the Great Globular Clusters, M. 3, M. 5, M. 13 and M. 92.'

E. E. BARNARD: 'Observations and Light Curves of some of the Small Variable Stars found in the Globular Clusters.'

A. O. LEUSCHNER: 'Notes on the Short Method of Determining Orbits from Three Observations.'

A. O. LEUSCHNER: 'A Method of Computing Orbits in Rectangular Coordinates.'

A. O. LEUSCHNER: 'The Solution of the Orbit Irrespective of Parallax and Aberration.'

A. O. LEUSCHNER: 'The Orbit of Comet 1902 a.'

G. H. PETERS: 'The Photoheliograph of the U. S. Naval Observatory; its Use and Defects in Solar Photography.'

SIMON NEWCOMB: 'Statement of the Progress made by the Watson Trustees in Computing Tables of the Asteroids discovered by James C. Watson.'

A. S. FLINT: 'Results of Meridian Observations for Stellar Parallax made at the Washburn Observatory.'

L. A. BAUER: 'Preliminary Summary of Magnetic Results obtained during the Recent Eruption in Martinique.'

S. D. TOWNLEY: 'The Light of the Stars.'

ABSTRACTS OF PAPERS.

Comparison of Astronomical Photographic Measures Made with the Réseau and without it: HAROLD JACOBY.

The *réseau* method of measuring stellar photographs, as considered in the present note, is similar to that in use by the observatories participating in the photographic survey of the heavens now in progress. The most important advantage of this method of measurement is that it avoids almost altogether the effects of possible contractions or expansions of the sensitive film during development; and to this advantage has been joined another of a practical character which was perhaps not foreseen by the originators of the *réseau* method. It is found most confusing to measure plates having nothing on their surfaces but stars-images; in fact, in the case of close clusters, it is well-nigh impossible on such plates to make sure that the two coordinates assigned to any star really belong to the same object. All this possibility of confusion disappears, however, with *réseau* plates, as it is easy to keep all measures in order by considering each little square by itself.

As usual, there are compensating disadvantages connected with the *réseau*. It is necessary, for instance, to make certain assumptions, such as the following:

1. That the division errors of the original *réseau* can be determined as accurately as those of a scale.

2. That the photographic copy of the *réseau*, as it appears on the star-plate, really reproduces exactly the division errors of the original.

3. That the bisection of the photographed *réseau* lines on the star-plate can be made with a microscope as accurately as the lines of a scale can be bisected.

It is of course possible to discuss each of these assumptions separately; but in the present note I shall consider one simple experiment only. This consisted in measuring a couple of Pleiades photographs twice, once by the *réseau* method, and once with a metallic scale. A simple comparison ought then to show how far the two methods of measurement differ in their results. Seventy-five stars were observed in each case, and the same stars were used. The first plate was made at Paris, January 14, 1901, and the 'probable discordance' between the two methods of measurement was $\pm 0''.11$. No corrections were applied for possible division errors of the Paris *réseau*, as none have been published, though the MM. Henry have satisfied themselves that the Paris *réseau* errors are inappreciable. The second plate was made at Helsingfors, December 12, 1900, and gave a probable discordance of $\pm 0''.22$. In this case, the measures were corrected with Donner's division errors, but these are not large enough to affect the result appreciably. In both cases, measures made with the metallic scale were corrected for the division errors determined at Columbia University. The larger discordance in the case of the Helsingfors plate is probably due to the less well defined character of the photographed *réseau* lines. In many cases it is impossible to bisect these lines under the microscope any-

where except at the corners of the squares, where two lines cross and form a point.

But when we consider that the above discordances involve the errors of both measurements, they do not appear unduly large. Divided by $\sqrt{2}$, they give for the probable error of a measurement by one method only $\pm 0''.08$ for Paris, and $\pm 0''.16$ for Helsingfors; and there is no evidence of a systematic arrangement of signs in the differences between the two methods. We may conclude, therefore, that plates measured by the *réseau* method and without it give identical results within a very narrow margin; nor does irregular distortion of the film appear to have affected appreciably the measures made without the *réseau*.

The Spectra of Stars of Secchi's Fourth Type: GEORGE E. HALE, FERDINAND ELLERMAN and J. A. PARKHURST.

In his early surveys of stellar spectra, Secchi divided the red stars into two great classes (his third and fourth types), whose spectra differ very markedly in their general characteristics. Subsequent investigations by Vogel and Dunér confirmed Secchi's conclusion with regard to the presence of carbon bands in the spectra of stars of the fourth type, but in view of the instrumental means employed it was impossible for these investigators to distinguish the individual lines in the spectra. An investigation of these stars was accordingly undertaken with a three-prism spectrograph, used in conjunction with the forty-inch refractor and the two-foot reflector of the Yerkes Observatory. Some 250 photographs, ranging in exposure-time from a few minutes up to twenty-five hours, were made. They include the yellow and green as well as the blue regions of the spectra. A special study has been made of eight stars, in whose spectra the wave-

lengths of several hundred bright and dark lines have been measured. The presence of bright lines, though suspected by Secchi, was denied by subsequent observers, but has been abundantly confirmed by the present photographs. Hitherto it has not been possible to identify these lines. A large part of the dark lines, however, have been found to be due to iron, titanium and various other substances. By the aid of these lines the radial velocities of the eight stars have been determined. The photographs bring out a marked resemblance between the spectra of the two classes of red stars, so far as the dark lines are concerned. Cyanogen is present in both classes, but carbon, either alone or in combination with oxygen, is absent from stars of Secchi's third type, while very conspicuous in stars of the fourth type. In both classes of stars the relative intensities of the dark lines in the spectrum of a given element seem to differ considerably from the corresponding intensities in the solar spectrum. This led to a comparison of the stellar lines with the widened lines in the spectra of sun-spots. So far as can be judged from the present photographs, there is a marked similarity of these spectra, but this can not be made the basis of any theoretical conclusions before further investigations with higher dispersion have been made. In general, the investigation tends to confirm the opinion of Vogel and Dunér that the two classes of red stars have developed from solar stars. Full details of the work, with tables of wavelengths and reproductions of photographs, will appear soon in the *Publications of the Yerkes Observatory*.

Radial Velocities of Twenty Stars having Spectra of the Orion Type: EDWIN B. FROST and WALTER S. ADAMS.

This paper represents a part of the work done during the past year with the new

Bruce spectrograph of the Yerkes Observatory. Stars with spectra of this interesting type, which seems certainly to characterize an early stage of stellar development, have not hitherto received much attention in respect to motion in the line of sight. These spectra are not adapted to measurements of any such degree of accuracy as is possible for the solar stars, because of the comparative fewness and the generally hazy and ill-defined character of their lines. The results have, however, proved more accordant than was anticipated. The general good adjustment and trustworthiness of the spectrograph are attested by the measures of the moon's radial velocity. The twelve lunar spectra photographed during the year gave a mean difference of 0.2 km. per sec. between the observed and the computed radial velocity, the largest difference being 0.7 km. per sec. The titanium spark was chiefly used for furnishing the comparison spectrum, but the iron and the chromium spark and a helium tube were also employed at times. A perfectly definite amount of self-induction and capacity was always maintained in the secondary circuit.

The lines commonly present and measured in the stellar spectra were those due to one or more of the following elements: helium, oxygen, silicon, nitrogen, hydrogen, magnesium. The observing list included about 150 stars of this type brighter than the sixth magnitude. The present paper included only those of which three or more plates have been obtained and measured. Those found to vary in their radial velocity, six in number, were not included in the discussion. The stars of the *Orion* type are peculiarly distributed in the sky, being for the most part grouped in or near the Milky Way. As many of the twenty are near the apex or anti-apex of the sun's way, the observed velocities clearly show the effect of the solar motion.

If a correction were applied for this motion, the resulting absolute radial velocities would be small. The angular proper motions of these stars are also small, and suggest a relatively great distance from our sun, as well as a 'community of interest' of these stars. The radial velocities observed, expressed in kilometers per second, are as follows:

γ Pegasi	+ 5	ϵ Can. maj.	+ 27
ζ Cassiopeia	+ 3	η Leonis	+ 4
ϵ Cassiopeia	- 6	γ Corvi	- 7
ζ Persei	+ 22	τ Herculis	- 13
β Orionis	+ 21	ζ Draconis	- 14
γ Orionis	+ 18	ι Herculis	- 16
ϵ Orionis	+ 26	67 Ophiuchi	- 4
ζ Orionis	+ 17	102 Herculis	- 11
κ Orionis	+ 17	η Lyrae	- 9
β Can. maj.	+ 33	ϵ Delphini	- 26

(Paper will appear in full in the 'Decennial Publications of the University of Chicago.')

New Spectroscopic Binaries: EDWIN B. FROST and WALTER S. ADAMS.

During the observations described above, six stars of the *Orion* type were found whose radial velocity varied. Preliminary statements have already been published as to three of these (γ Orionis, ν Persei, β Cephei). The others are δ Ceti, ζ Tauri and ν Eridani. Of δ Ceti we have obtained eleven plates since November 1, 1901, which give a range from + 6 to + 16 km. per sec. The period is short, but observations on consecutive nights will be necessary for its establishment.

The plates of ζ Tauri available are ten in number (from November 8, 1901, to December 18, 1902), and give a range from + 7 to + 34 km. The period can not yet be given, but may, perhaps, be about fourteen days. The spectrum is rather unique in respect to its very sharp and strong γ and β lines of hydrogen, with the other lines (some of them metallic) very faint.

One plate of ν *Eridani* was obtained in the autumn of 1901, and four a year later. The range of velocity so far observed is from +3 to +26 km. per sec.

We regard two or three other stars with spectra of the *Orion* type as suspicious of variable radial velocities, but the number of plates so far obtained is insufficient to establish the variation. The proportion of spectroscopic binaries, found by us in this special class of stars, to the number of which we have obtained three plates is about 1:5.

The Orbit of the Spectroscopic Binary η Orionis: WALTER S. ADAMS.

The variation in the radial velocity of η *Orionis* was discovered at the Yerkes Observatory in December, 1901, by Professor E. B. Frost and the writer. Since that time twenty-eight spectrograms have been secured, covering an interval of very nearly a year, and in the present paper the star's orbit is computed from them by the method of Lehmann-Fillies. The greatest range found is about 285 km., and is the largest which has hitherto been discovered among binaries which like this have one component dark. The spectrum is of the *Orion* type, but contains several silicon, oxygen and nitrogen lines as well.

The period used in plotting the observations is 7.9896 days, and the following elements are found:

Velocity of system $V = +35.5$ km.

$u_2 = 90^\circ 41'.6$

$w = 42^\circ 16'$

$e = 0.016$

$\mu = 45^\circ.059$

$T = 1901, \text{ December } 1.821$

$a \sin i = 15,991,000$ km.

An ephemeris is computed with these elements, and the greatest difference between the observed and computed velocities is found to be less than 3 km.

The Masses in 85 Pegasi: GEORGE C. COMSTOCK.

85 *Pegasi* is a sixth magnitude star with an eleventh magnitude companion distant less than a second of arc. Burnham, who discovered the pair in 1878, has published an orbit with a periodic time of 25.7 years. The bright star of the pair has been frequently compared with a neighboring ninth magnitude star, and from a discussion of these measures covering a period of fifty years I find for the masses of the sixth and twelfth magnitude stars the ratio, 2:3, the faint star having the greater mass, although its light is only a hundredth part that of the brighter star.

This result is directly opposed to the common view that regards the fainter component of a binary star as more nearly extinct than its companion, because a smaller mass has caused it to traverse more rapidly the stages of development that lead to extinction.

Stellar Revolutions within the Galaxy: FRANK W. VERY.

Independent estimates of the parallax of *Nova Persei* give

$$\pi = 0''.052, \text{ and } \pi = 0''.049,$$

whence it is concluded that the distance of this presumably galactic object is about 600,000,000,000 km. It is proposed to adopt this distance as a first approximation to the sun's distance from the Milky Way.

The first-type stars, of which the galactic stream is mainly composed, probably have rather small linear velocities, and are the result of agglomerative tendencies; but around the central condensations there is a great sphere of stars, mostly in advanced stages of development, which seems to have been produced by stellar dispersal. These outlying stars may have been thrown off from the central condensations by explosions of great magnitude; and if the ve-

locity of recession is not too great, these stars thenceforth revolve around controlling centers, consisting of densely clustering stars, in periods embracing many millions of years.

The attraction of a spherical mass of stars, equivalent to 10,000,000 such suns as ours, the aggregate extending to ten times the assumed solar distance from the Galaxy, is sufficient to produce the present solar velocity (20 km. per sec.) in moving from rest at the outer limit, and to give an oscillation from one extreme to the opposite boundary in a little over 40,000,000 years. With a central galactic condensation sufficient to turn the movement into an eccentric orbital revolution, if apogalactium is ten times as far away and perigalactium one tenth as far from the center of motion as the assumed galactic distance, the period of revolution will be shortened, but can not be less than about 6,000,000 years for a circular orbit around a central cluster. The general stellar sphere controls the movement in an elongated orbit at the greater distances, but the massive central agglomerations exercise directive power at the closer approach.

There are certainly more than 10,000,000 stars. Hence, either their attractions are largely mutually annulled through symmetrical external position, or else most of the stars have masses very much less than that of the sun, which must be above the average mass.

As the true proper motions of the stars show little preference for particular directions, the dispersals have occurred indiscriminately in all directions.

The diverse regions of space traversed by the sun in its progression from perigalactium to apogalactium may have very different meteoric contents whose reception produces secular changes in the planetary atmospheres, and may influence the development of living forms indirectly.

The apex of the sun's way is now about 20° from the axis of the galactic stream. At perigalactium the apex will recede to the galactic pole, and the direction of motion of the apex in the interim will determine the axis of the solar orbit.

Preliminary Announcement with regard to the Proper Motions of Certain Faint Stars: GEORGE C. COMSTOCK.

The author has measured micrometrically the positions of 45 faint stars (ninth to twelfth magnitudes) referred to brighter neighboring stars whose proper motions were accurately known. From a comparison of these observations with older data of a similar kind, principally the measurements made by the Struves, he has derived proper motions of the faint stars, which in respect of precision are quite comparable with the proper motions of the fainter fundamental stars, *e. g.*, those of the fifth and sixth magnitudes.

These proper motions, although relatively few in number, furnish a determination of the sun's motion in space entirely independent of all previous data, and based upon stars whose average distance from the solar system is much greater than any hitherto employed. The resulting solar motion is in substantial agreement with previous determinations, and when combined with spectroscopic determinations of the velocity of the sun's motion it furnishes as the mean parallax of the stars observed (magnitude 10.5) the value $0''.005$ (40,000,000 radii of the earth's orbit) which is in substantial accord with the extrapolated value furnished by Kapteyn's researches upon the brighter stars.

Other results of the present investigation are: (1) That the proper motions of the fainter half of this list of stars do not seem to be materially less than those of the brighter half, *i. e.*, the eleventh and twelfth magnitude stars are not more distant than

those of the ninth and tenth magnitudes; (2) that the average linear velocity with which these faint stars move through space is of the same order of magnitude as that of the brighter stars and about fifty per cent. greater than the velocity of the sun.

An Inquiry into the Cause of the Nebulosity around Nova Persei: FRANK W. VERY.

Lockyer's hypothesis of colliding meteor swarms would require spherical swarms of enormous dimensions, and in other respects it does not fit the facts. Radiation hypotheses do not explain the duplicity, or possible triplicity, of the nebulous ring, nor the double ratio of the radii of the two principal rings; neither is the retardation of the expansion satisfactorily accounted for. Reflection hypotheses are absolutely barred, because they demand an impossible albedo in the nebula.

The supposition that the motion is a real one involves the further hypotheses that it is due to particles of corpuscular dimensions, expelled from great masses of intensely heated gas, surrounding the nova, in moments of powerful electric oscillatory discharges; that these discharges assist to ionize the material and start a series of instantaneous magneto-electric impulses which guide the moving particles along lines of magnetic force; that the material is probably diamagnetic and will finally come to rest in loci of least magnetic potential; that the velocity imparted depends on the masses of the ions which appear to be in the ratio 1:2:4; that the velocity is accelerated out to a radius at which magnetic repulsion and gravitational attraction are equal for particles of the given dimensions, and that at greater distances the velocity is retarded. An estimate of the mass and diameter of the nova indicates that, at the surface of the star, the ratio of magnetic force to gravity

may be as great as 100,000 to 1 for these minute particles; and as such a force would be capable of generating in a corpuscle a velocity of 100,000 km. per sec. in one second, if it were possible fully to utilize it for this purpose, the only objection which can be urged against the hypothesis is the difficulty of imagining a process by which this force can be economically applied.

In favor of the hypothesis it can be stated that the theoretical variation in the rate of expansion of the nebula has been observed; that the observed motions of nebulous forms agree well with those to be expected if the phenomenon is a species of magnetic phantom; that there are curved and diverging streamers on the south-southwest side, resembling the sheaves of diverging coronal filaments about the sun's poles; that the absence of a corresponding sheaf on the north-northeast side may be explained on Doppler's principle; that the disappearances of certain forms in the outer of the two principal rings after reaching a radius of 14' to 16', and the phenomenal and sudden appearance of bright forms at about the same positions, are to be explained on the same principle; that such appearances and disappearances are demanded on the magnetic hypothesis, and are extraordinary anomalies on any other.

It is concluded, therefore, that the nebula resembles a gigantic corona; that its axis is inclined 40° to the line of sight on the south-southwest side; and that the expansion of the nebula is approaching its limit.

The Mounting of Fixed Meridian Instruments: G. W. HOUGH.

The variation in level and azimuth in fixed meridian instruments is due to the effect of temperature: (1) On the metal outside the piers, (2) on the metal in the piers, (3) on the supporting piers, and (4)

to the motion of the base of the pier. In order to understand how the temperature acts on meridian instruments, we need some physical constants. If we assume the conductivity of iron as one, or unity, mercury is $1/10$, stone, brick and wood $1/130$ to $1/180$. It will be readily understood that the iron outside of the pier will act quickly as a thermometer, the iron inside the pier will act more slowly, and the supporting piers will act very slowly in taking the temperature of the external air.

The piers acting as a thermometer may lag one month or more, and this is the explanation of the phenomenon observed at Edinburgh. Hence we conclude that variation of level and azimuth during a night of observation is almost entirely due to the effect of temperature on the metal parts of the instrument. The covering of piers with cloth and wood is of no use.

Many instruments in use change their level and azimuth by jumps, and not in any regular manner. If the expansion of iron is taken as unity, brass is 2, sandstone and granite 0.8 to 0.9, and bricks from 0.3 to 0.5. It is readily seen that the difference of expansion between brick and iron is so great that the instrument will always be loose on the piers. Hence it is free to jump in both level and azimuth.

In the Pistor & Martin's meridian circle the brass cylinder for holding the Y should be replaced with iron.

The modern Repsold is defective in its mechanical construction, for the reason that the Y-piece and the counterpoise weight are all supported on one frame, and when the instrument is reversed it is liable to be disturbed in level and azimuth. The Dearborn Observatory old pattern Repsold meridian circle is mounted on sandstone piers, and the lugs for holding the Y-pieces are set in with lead. The instrument is absolutely stable in level and in azimuth.

The computed monthly level for two years, when corrected for temperature and the motion of the pier, agrees with the observed level within a fraction of a second of arc.

The Probable Value of the Constant of Aberration: S. C. CHANDLER.

The number of determinations of this constant is now so considerable that even wide differences of judgment as to the weights to be assigned them can have but little influence on the mean result. Forty-three determinations are combined with the following weights:

Talcott's method.....	20.523	Weight, 151
Meridian declinations.....	.514	22
Prime vertical transits.....	.525	24
Right ascensions.....	.53	6
Prismatic apparatus.....	.48	5
Mean	20.521	208

The Constant of Aberration from Observations with the Zenith Telescope, 1901-1902: C. L. DOOLITTLE.

A preliminary reduction of the series of zenith telescope observations covering the period from October 1, 1901, to October 1, 1902, gives for this constant the value $20''.510$.

This is preliminary in the sense that some of the work of reduction has not been fully verified and that it is proposed to include in deriving the final result some additional data, viz., about four hundred observations between October 1, 1902, and January 1, 1903.

The values derived from the different series of observations at the Sayre and Flower Observatories are as follows:

(1) 1889-1890	$20''.448 \pm 014$	Weight $\frac{1}{2}$
(2) 1892-1893	20.551 ± 009	1
(3) 1894-1895	20.537 ± 014	1
(4) 1896-1898	20.580 ± 008	$\frac{1}{2}$
(5) 1898-1899	20.540 ± 010	1
(6) 1900-1901	20.561 ± 008	1
(7) 1901-1902	20.510	1
Weighted mean.....	$20''.539$	
Unweighted mean.....	20.532	

I have elsewhere given reasons for suspecting the genuineness of result (1). There are also reasons for the small weight assigned to result (4) aside from the somewhat larger value given.

It is proposed to continue this series for another year. It will then be terminated unless means can be had for giving the investigation a wider scope. For a number of years I have been hoping that I might be able to set up an instrument of different construction and have a second series of observations carried on simultaneously with my own for a period of at least two or three years. At present the necessary means are not available, but I have not entirely abandoned this project.

Micrometrical Measures of Individual Stars in the Great Globular Clusters: E. E. BARNARD.

The great power of the forty-inch refractor of the Yerkes Observatory has been utilized in a systematic micrometrical survey of between 600 and 700 small stars in the globular clusters *M* 3, *M* 5, *M* 13 and *M* 92.

The paper deals mainly with the measures of stars in *M* 13 *Herculis* and a comparison of these with measures made by Dr. Schriener, of Potsdam, in 1891, of photographs of the cluster. This comparison shows a generally close agreement between the photographic and visual measures. There are a few discordances amounting to one or more seconds of arc. There does not seem to be any proof that these are due to motion in these stars, but rather due to the difficulty of making the photographic measures. In the ten years' interval there does not appear to be any certain proof of motion in any of the stars under observation. In the work with the large telescope the stars are referred to a standard star in each cluster. This star is accurately measured with reference to known

stars, and its absolute position given, from which the exact place of any one of the small stars observed can be easily deduced. The measures were made by the method of position angle and double distances, though the relative position of the stars to the standard stars are given in the order of Δa and $\Delta \delta$.

On Some of the Variable Stars in the Cluster M 5, Libræ: E. E. BARNARD.

These are observations of some of the variable stars discovered in this cluster by Professor S. I. Bailey.

The smaller stars all have periods of nearly half a day, but there are three bright stars—the brightest in the cluster—which have relatively long periods. These periods are:

Star No.	Period, Days.	Light Range.
42	25.7739	1½ m.
84	26.5760	1½ m.
50	106.17	1 m.

The first two rise rapidly to maximum and decline slowly to minimum. No. 50, which seems to have the longest period in the cluster, differs markedly from the other two in that its rise and decline are both slow and uniform. All three are slightly yellowish at maximum.

Several of the small, quick-period variables were under observation. The best observed of these was No. 33, whose period is $0^d 12^h 2^m 7^s.6$, and whose light range is about one magnitude ($1^m.1$). The light curve for this star is rather remarkable.

The normal condition is faint at about $14\frac{1}{2}$ mag. At about one hour before maximum it begins to rise. Its light increases rapidly, and the duration of maximum is very short. The star then declines about as rapidly as it rose, for about forty minutes. It then seems to halt in the decline, and from this on sinks very slowly to minimum, not reaching its faintest or normal condition until seven or eight hours after maximum.

Notes on the Short Method of Determining Orbits from Three Observations: A. O. LEUSCHNER.

In order further to simplify the computation of preliminary orbits, the author proposes several modifications in the application of his 'Short Method, etc.' (*Publications L. O.*, Vol. VII., part 1):

1. The accuracy of ρ_0 is increased by eliminating the parallax from the second observation through simple corrections applied to the corresponding solar coordinates in group I.

2. When the parallax factors for the three observations differ materially, the accuracy of the geocentric velocities is increased by applying the parallax corresponding to the unit of distance to all three observations in the formulæ of group II.

3. No correction for parallax is to be applied to the middle observation on the basis of the successive approximations for ρ_0 (cf. groups V., VII.), but instead the parallax is to be eliminated once for all by correcting the rectangular equatorial solar coordinates for the normal date as follows:

$$\begin{aligned}\Delta X &= (p_a \rho_0) \sin a_0 \cos \delta_0 + (p_b \rho_0) \cos a_0 \sin \delta_0, \\ \Delta Y &= - (p_a \rho_0) \cos a_0 \cos \delta_0 + (p_b \rho_0) \sin a_0 \sin \delta_0, \\ \Delta Z &= - (p_b \rho_0) \cos \delta_0.\end{aligned}$$

4. By replacing the A and B by

$$A' = A + \cos \delta \, p_a / \rho^2, \quad B' = B + p_b / \rho^2.$$

respectively, in the differential formulæ (group VII.), terms depending on the parallax factors are introduced which will minimize the effect, on the residuals, of changes in parallax, and the convergence is increased.

5. The sufficiency of the differential formulæ should be tested by checking the new residuals obtained in group VII. by means of the corresponding formulæ of group VI.

6. Simple formulæ involving the squares of the corrections have been derived for those rare cases in which the linear relations are found to be insufficient.

7. The new values of x_0, y_0, z_0 (group VII.) may be found rigidly in all cases by changing the former values by

$$\begin{aligned}\partial x_0 &= \cos a_0 \cos \delta_0 \partial \rho_0, & \partial y_0 &= \sin a_0 \cos \delta_0 \partial \rho_0, \\ \partial z_0 &= \sin \delta_0 \partial \rho_0.\end{aligned}$$

8. The method may be applied to longer arcs by using closed expressions in place of the series in group VI.

A Method of Computing Orbits in Rectangular Coordinates: A. O. LEUSCHNER.

From

$$\omega_a = f_a \omega_0 + g_a \omega_1 \quad (\omega = x, y, z)$$

(*Publications L. O.*, Vol. VII., part 1) the author derives the three fundamental equations:

$$\omega_0 = \frac{g_{111}}{f_1 g_{111} - f_{111} g_1} \omega_1 - \frac{g_1}{f_1 g_{111} - f_{111} g_1} \omega_{111}.$$

Introducing

$$\rho \cos a \cos \delta = x + (X)$$

in the first of these three equations, it becomes

$$\begin{aligned}& \frac{g_{111}}{f_1 g_{111} - f_{111} g_1} \rho_1 \cos a_1 \cos \delta_1 \\ & - \frac{g_1}{f_1 g_{111} - f_{111} g_1} \rho_{111} \cos a_{111} \cos \delta_{111} - \rho_0 \cos a_0 \cos \delta_0 \\ & + (X)_0 - g_{111}(X)_1 + g_1(X)_{111} = 0\end{aligned}$$

where the (X) (similarly the (Y) and (Z) in the remaining two equations) are the solar coordinates, corrected, to eliminate parallax, by the formulæ given in 3 of the foregoing 'Notes.' These coordinates are referred to the beginning of the year and apply to the actually observed dates.

The solution of the fundamental equations gives at once

$$\rho_0 = \frac{c_x D' + c_y D'' + c_z D'''}{D}$$

where the D are simple functions of the uncorrected observations, and

$$c_x = (X)_0 - \frac{g_{111}}{f_1 g_{111} - f_{111} g_1} (X)_1 + \frac{g_1}{f_1 g_{111} - f_{111} g_1} (X)_{111}$$

or otherwise

$$c_x = (X)_0 - \frac{[r_{11} r_{111}]}{[r_1 r_{111}]} (X)_1 - \frac{[r_1 r_{11}]}{[r_1 r_{111}]} (X)_{111}$$

and where c_y, c_z are given by similar expressions. If not previously available, a first approximation to the triangular ratios may be obtained by the 'Short Method, etc.' Next $\rho_1, \rho_{111}, x'_0, y'_0$ and z'_0 are obtained by simple expressions. The accuracy of the initial values of the ratios of the triangles is now tested by recomputing them from closed expressions or by the series. Any disagreement between the initial and final values is removed by means of differential formulæ. The elements are computed by formulæ VIII. of the 'Short Method.' The use of rectangular coordinates as outlined in the paper presents many advantages and is applicable to long arcs.

The Solution of an Orbit, Irrespective of Parallax and Aberration: A. O. LEUSCHNER.

In the 'Method of Computing Orbits in Rectangular Coordinates' the effects of parallax and aberration are fully eliminated, except in the expressions for the ratios of the triangles, in which the θ 's are affected by the difference of planetary aberration (e. g., $\theta_{11} = k(t_{111} - t_1)$). In certain rare cases, particularly for very short intervals, the c_x, c_y, c_z become so small that the solution will become indeterminate unless the accurate differences in planetary aberration can be introduced at the start. In a first orbit, therefore, recourse is had to eliminating the first powers of the differences in aberration, by

segregating the first powers of the θ 's as factors from c_x, c_y, c_z and then replacing them by expressions involving the differences of aberration, e. g.,

$$\theta_1 = \theta_1^0 - ka(\rho_{111} - \rho_1).$$

The fundamental equations then take the form

$$a\rho_1 + b\rho_0 + c\rho_{111} + d + ka\rho_{111}\rho_1 + ka\rho_{111}\rho_0 + ka\rho_0\rho_1 = 0,$$

where a is the aberration factor.

The solution of these equations is reduced to the solution of two equations of the form

$$\rho_0 = f(\rho_{111} - \rho_1) \quad \text{and} \quad \rho_{111} - \rho_1 = \phi(\rho_0)$$

from which $(\rho_{111} - \rho_1)$ and ρ_0 are obtained.

The Orbit of Comet 1902 a: A. O. LEUSCHNER.

The paper contains a preliminary report on the investigation of the orbit of comet 1902 *a*. A preliminary orbit based on three observations, of which the third represented a single micrometric measure in α and δ was published shortly after the appearance of the comet. The elements, which were computed by the 'Short Method,' indicated an unusually short period. A comparison of the sum of the squares of the residuals from the elliptic with those from a parabolic orbit computed at Kiel gave the following results for the first nine observations;

[vv] parabolic orbit 2985

[vv] elliptic orbit 711

For further investigation the observations were grouped into six places, three of which represent single observations, one was based on two, one on three, and one on five observations. The best three of these were selected for the improvement of both the parabolic and elliptic orbits. The final parabolic orbit is completed and does not represent the

observations so well as the preliminary elliptic orbit. In determining the final elliptic orbit many difficulties were encountered which led to the theoretical results given in the foregoing papers. The calculation of an orbit irrespective of parallax and aberration has just been undertaken. A preliminary improvement of the orbit gave evidence that the first results concerning a very short period will be substantiated. The following students and assistants have taken part in the computations: Dr. R. T. Crawford; Messrs. H. K. Palmer, Joel Stebbins, Ralph Curtiss, C. A. G. Weymouth, Fellows in the Lick Observatory; and Miss A. M. Hobe.

The Photoheliograph of the U. S. Naval Observatory; Its Use and Defects in Solar Photography: G. H. PETERS.

This paper dealt with the changes made in the instrument during the past four years. A considerable variation of focal length has been found, amounting to about one half inch, between the temperature of summer and winter. In a proposed new and larger instrument, some defects due to the attached building are to be avoided.

The use of Jena glass No. 0.2164 combined with No. 0.2001, with an alternative of No. 0.164, is suggested for this lens, to reduce the secondary spectrum to a minimum.

Attention was called to the necessity of a study of the thermo-focal changes in long focus lenses, to be used in eclipse work.

Results of Meridian Observations for Stellar Parallax made at the Washburn Observatory, University of Wisconsin: ALBERT S. FLINT.

Results were presented for a list of ninety-six stars whose distances from the solar system were to be determined. This list consists mainly of stars whose proper motion, or drift across the heavens, is com-

paratively large; and these results show that, on the average, the larger this apparent motion, the nearer the star. These observations were forwarded to Professor Kapteyn, of Groningen, Holland, who made use of them in an important investigation of the structure of the heavens.

Preliminary Statement of the Magnetic Disturbances Coincident with the Recent Eruption in Martinique: L. A. BAUER.

The disturbances of the magnetic needle coincident with the volcanic eruption of May 8 and 20 were felt practically simultaneously at the four Coast and Geodetic Survey magnetic observatories situated respectively at Cheltenham (Maryland), Baldwin (Kansas), Sitka (Alaska) and Honolulu (Hawaiian Islands).

In response to a circular sent by the Superintendent of the Coast and Geodetic Survey records have been received from the principal foreign observatories. A cursory examination of these records shows the disturbances and that they occurred practically simultaneously at all of the observatories thus far heard from. An examination of the records indicates that apparently there were premonitory symptoms a month before the actual outbreak. The records will be subjected to a critical discussion, with the view of settling definitely whether the cause of these remarkable disturbances had its source within or outside of the earth's crust.

A comparison of these effects was made with that which had revealed itself during the total solar eclipse of May 28, 1900, and also the more recent one of May 18, 1901. It was shown that the eclipse effect is not in any sense to be classed as a magnetic disturbance, but that it is of the periodic variation kind and is precisely similar in character to the solar diurnal variation.

Preliminary Note on the Total Light of the Stars: SIDNEY D. TOWNLEY.

While engaged in photometric work at the Lick Observatory during the past summer a few experiments were made to determine the amount of light received from the sky at night when the moon is not shining. This work was undertaken at the request of Director Campbell, to whom the problem was suggested by Professor Newcomb.

Both visual and photographic methods are applicable to the solution of this problem, and Professor Newcomb has already employed some of the visual methods, the results of which were printed in the *Astro-physical Journal*, December, 1901. My efforts were directed almost exclusively to perfecting a photographic method. The results thus far obtained are meager, but it is believed that a reliable method has been found.

The method adopted is, indeed, very simple. Both lenses were removed from the Crocker photographic telescope and a cardboard cap of three centimeters diameter attached to the end of the telescope tube. An exposure of one hour was made upon a bright star and the result was, of course, an impression on the plate of the size and shape of the aperture. Exposures were then made upon the sky by means of four camera boxes, consisting simply of aperture and plate, attached to a polar axis made of a piece of 4 x 4. The angular apertures used varied from five to ten degrees. The five plates were developed at the same time in a large tray, and their relative intensities measured by means of a Lummer-Brodhun photometer.

In the very limited length of time which I had to devote to this work it was possible to obtain only a few sets of plates. Two of these sets give reliable results. In each Vega was the comparison star used. In

the one the camera boxes were directed to the sky about half way between γ Pegasi and β Ceti, in the other to the Milky Way nearest Vega.

The results are, from the first, that the light of Vega is equivalent in actinic intensity to the light received from an area of rather vacant non-galactic sky $7^{\circ} 16'.4$ in diameter, from the second, that the light of Vega is equivalent to the light received from an area of galactic sky $5^{\circ} 19'.8$ in diameter. This gives galactic sky to be 1.9 times brighter than non-galactic sky. If we take the magnitude of Vega to be 0.2, then from the first result we find that the light received from an area of non-galactic sky one degree in diameter is equal to the light of a 4.5 magnitude star, which is not far from the result obtained by Professor Newcomb, namely, that the light received from an area of non-galactic sky one degree in diameter is equal to 0.9 the light of 5.0 magnitude star.

Photometric and Photographic Observations of Faint Variable Stars: J. A. PARKHURST.

In the course of this work at the Yerkes Observatory several stars have been found whose brightness at minimum is at or below the limit of the 40-inch refractor. To illustrate three specimen fields, lantern slides were prepared from negatives taken with the 24-inch reflector, covering a field of $30'$ around the variable, corresponding to the inner square of Hagen's charts.

7220 S Cygni.—Plate taken November 24, 1902, exposure 61 minutes. The variable is about 11th magnitude; its greatest range of variation is from the 8th to the 16th magnitude, being approximately equal at maximum to the star $1'$ north, and at minimum to the star $0'.5$ preceding.

7458 V Delphini.—Plate taken September 7, 1902, exposure 68 minutes. This star has perhaps the greatest range of any

known variable. At the maximum of 1899 it reached nearly the 7th magnitude, at minimum it is about the 17th magnitude. As shown on the slide it is 10th magnitude, at its faintest it is equal to the small star 0'.2 south.

7582 *X Cephei*.—Plate taken March 13, 1902, when the variable was photographically fainter than 17th magnitude, and visually below the limit of the 40-inch when using the eyepiece of the photometer, power 237. The magnitude at maximum is 9.7, equal to the star 4' south, 1' following.

The work in progress includes determination of the photometric magnitudes of comparison stars for 25 faint variables, using the equalizing wedge photometer devised by Professor E. C. Pickering, in connection with telescopes of 6, 12 and 40 inches aperture; connecting the comparison stars with Harvard and Potsdam standards in the neighborhood; also visual comparisons by Argelander's method, and photographs of the fields for the purpose of certain identification of the comparison stars, and for determining the brightness of the variable when below the visual limit of the telescopes used.

W. S. EICHELBERGER,
For the Council.

THE ASSOCIATION OF AMERICAN ANATOMISTS.

THE sixteenth session of the Association of American Anatomists, meeting in conjunction with the American Society of Naturalists and other affiliated societies, was held in Washington, D. C., December 30 and 31, 1902. The association met in the Columbian University Medical School.

The association gave consideration, at its general business session, to the following recommendations made by the executive committee:

1. They accepted the invitation tendered

by the American Association for the Advancement of Science, to form an affiliation with this association, agreeing to elect a delegate to the council of the American Association for the Advancement of Science. Such affiliation impairs in no degree the integrity of the Association of American Anatomists and does not bind this association to meet with the American Association for the Advancement of Science, unless it deems it expedient.

2. In view of the fact that the regular annual meeting of this association was held this year in Washington, it was deemed inadvisable to arrange for a second meeting at this place in May of the present year, in conjunction with the other American associations and societies participating in the Congress of American Physicians and Surgeons. This association, therefore, moved that the meeting in connection with the Congress of American Physicians and Surgeons in May, 1903, be omitted.

3. It was moved to omit from the program the abstracts of papers presented at the meetings.

4. The following addition was made to the by-laws of the association: 'Newly elected members must qualify by payment of dues for one year within thirty days after election.'

5. It was voted that any change in the constitution of this association must be presented in writing at one meeting in order to receive consideration and be acted upon at the next meeting; due notice of the proposed change to be sent to each member at least one month in advance of the meeting at which such action is to be taken.

6. The following amendment to Article V. of the constitution was proposed at this meeting and will receive consideration at the next annual meeting:

"Candidates for membership must be persons engaged in the investigation of

anatomical or cognate sciences, and shall be proposed in writing to the executive committee by two members, who shall accompany the recommendation by a list of the candidate's publications, together with the references."

7. On motion of Dr. James Playfair McMurrich, it was voted 'that a committee of three be appointed to select topics for cooperative investigation by the members of the association.'

The following officers were elected: Professor Charles S. Minot, Boston, member of the executive committee (five years), to succeed himself; Dr. Joseph A. Blake, New York City, delegate to the executive committee of the Congress of American Physicians and Surgeons, to succeed himself; Professor Simon H. Gage, Cornell University, delegate to the council of the American Association for the Advancement of Science.

Nineteen new members were elected.

The following papers were presented:

DR. ROBERT R. BENSLEY (Hull Laboratory of Anatomy, Chicago): 'On the Histology of the Glands of Brunner.'

DR. ROBERT R. BENSLEY: 'The Histogenetic Differentiation of the Specific Elements of the Gastric Glands of the Pig.'

DR. SIDNEY KLEIN (Hull Laboratory of Anatomy, Chicago): 'On the Nature of the Granule-cells of Paneth in the Intestinal Glands of Mammals.' (Presented by Dr. Robert R. Bensley.)

DR. JOSEPH MARSHALL FLINT (Hearst Anatomical Laboratory, University of California): 'The Development of the Framework of the Submaxillary Gland.'

DR. ROSS G. HARRISON (Anatomical Laboratory, Johns Hopkins University): 'On the Differentiation of Muscular Tissue when Removed from the Influence of the Nervous System.'

DR. WILLIAM S. MILLER (University of Wisconsin): 'The Terminal Arrangement of the Bronchi in the Cat.'

DR. WILLIAM S. MILLER: 'Three Cases of Pancreatic Bladder in the Cat.'

DR. G. CARL HUBER (University of Michigan): 'On the Morphology of the Sudoriparous and Allied Glands.'

DR. WILLIAM KEILLER (Department of Medicine, University of Texas): 'On the Preservation of Subjects for Dissection by Injection with Formalin and Carbolic Acid Solution, and Storage by Immersing in Similar Solutions.'

DR. WILLIAM A. SPITZKA (Department of Anatomy, Columbia University, New York City): 'The Anatomy of the Human Insula in its Relation to the Speech Centers; According to Race and Individuality.'

DR. D. K. SHUTE (Washington, D. C.): 'Sinuses or Air Chambers in Communication with the Nasal Fossæ.'

DR. THOMAS G. LEE (University of Minnesota): 'Notes on the Early Development of Rodents.'

DR. G. S. HOPKINS (Cornell University): 'Notes on the Variation in Origin of the Internal Carotid of the Horse.'

DR. R. H. WHITEHEAD (University of North Carolina, from the Hull Laboratory of Anatomy, Chicago): 'A Study of the Histogenesis of the Adrenal of the Pig.'

DR. GEORGE S. HUNTINGTON (Columbia University, New York City): 'The Derivation and Significance of Certain Supernumerary Muscles of the Pectoral Region.'

DR. JAMES PLAYFAIR McMURRICH (University of Michigan): 'The Evolution of the Flexor Sublimis Digitorum.'

DR. ALBERT C. EYCLESHYMER (Hull Laboratory of Anatomy, Chicago): 'The Histogenesis of Striated Muscles of *Necturus*.' (Presented by Dr. Lewellys F. Barker.)

DR. LEWELLYS F. BARKER (Hull Laboratory of Anatomy, Chicago): 'On the Relation of the Third Fœtal System of Trepinski in the Dorsal Furiculi to the Nucleus Dorsalis and the Fasciculus Cerebello-spinalis.'

DR. BURT G. WILDER (Cornell University): 'The Mesial Aspect of the Left Hemicerebrum with Selected Humans and Representative other Primates.'

DR. BURT G. WILDER: 'Reasons why Orderly, Educated and Fairly Prosperous Whites should leave their Brains for Scientific Purposes; with Suggestions for Form of Brain Bequest.'

DR. BURT G. WILDER: 'Queries as to the Human Ankle-joint and the Peroneus tertius.'

The following papers were read by title:

DR. GEORGE E. SHAMBAUGH (Hull Laboratory of Anatomy, Chicago): 'The Circulation in the Internal Ear of *Sus scrofa domestica*.'

DR. J. RALPH HARRIS (Washington, D. C.): 'A Comparison of Human and Orang Hearts,' with lantern slides.

DR. DANIEL G. REVELL (Hull Laboratory of Anatomy, Chicago): 'An Anomaly of the Vena Cava Inferior.'

One afternoon was given over to demonstrations. This proved an especially attractive and instructive feature of the meeting.

The following demonstrations were made:

DR. CHARLES R. BARDEEN: (a) The effect of fatigue on muscle nuclei (P. K. Tilman); (b) nerve and muscle preparations; (c) students' charts made during dissection.

DR. ROSS G. HARRISON: (a) Specimens illustrating the differentiation of muscular tissue when removed from the influence of the nervous system; (b) specimens illustrating the development of the lateral line and wandering of the skin in the amphibian embryo.

DR. G. CARL HUBER: (a) Models of sudoriparous and allied glands; (b) photograph of a new apparatus for making wax plates for reconstruction after the method of Born.

DR. WILLIAM KEILLER: Specimens illustrating the state of preservation of material injected by formalin and carbolic acid solutions, also wet and dry museum preparations.

DR. HENRY MCE. KNOWER (Secretary of the editorial board of *American Journal of Anatomy*): A demonstration on illustrations for anatomical publications.

DR. WILLIAM S. MILLER: (a) Models illustrating the terminal arrangement of the bronchi in the cat; (b) specimens illustrating pancreatic bladder in the cat; (c) the lymphatics of the lung of *Necturus*.

DR. BURTON D. MEYERS (Anatomical Laboratory, Johns Hopkins University): Specimens illustrating the partial decussation of the optic fibers in the chiasm of some mammals, and the commissures on the floor of the third ventricle.

DR. FLORENCE R. SABIN (Anatomical Laboratory, Johns Hopkins University): Gross and microscopic preparations of developing lymphatics.

DR. EDWARD A. SPITZKA: Drawings and plaster models, illustrating the anatomy of the human insula in its relation to the speech-centers.

DR. MERVIN T. SUDLER (Cornell University): Photographs of the lymphatic system and topo-

graphical dissections as made in the anatomical course of the Cornell University Medical College.

DR. ABRAM T. KERR (Cornell University): Corrosion preparations.

G. CARL HUBER,
Secretary.

THE ASSOCIATION OF ECONOMIC ENTOMOLOGISTS.

THE fifteenth annual meeting of the association met in the Natural History Room of the Columbian University, Washington, D. C., Friday and Saturday, December 26 and 27, 1902. The attendance throughout was quite large and the meeting was one of the most successful in the history of the association. The following papers were presented:

W. B. ALWOOD, Blacksburg, Va.: 'Injury by Seventeen-year Locust.'

W. E. BRITTON, New Haven, Conn.: 'The Lime, Sulfur and Salt Wash in Connecticut.'

A. F. BURGESS, Columbus, Ohio: 'Economic Notes on the Coccinellidæ.'

F. H. CHITTENDEN, Washington, D. C.: (1) 'Notes on the Larger Sugar-beet Leaf Beetle, *Monoxia puncticollis* (Say)'; (2) 'Notes on Insects that have Recently been Injurious to Truck Crops.'

E. W. DORAN, Champaign, Ill.: 'Vernacular Names of Insects.'

E. P. FELT, Albany, N. Y.: (1) 'The Literature of American Economic Entomology' (presidential address); (2) 'Observations on the Grapevine Root Worm'; (3) 'Results Obtained with Certain Insecticides'; (4) 'Notes on Injurious Insects.'

JAMES FLETCHER, Ottawa, Canada: (1) 'Can the Pea Weevil be Exterminated?'; (2) 'Injurious Insects of the Year in Canada.'

V. L. KELLOGG, Stanford University, Cal.: 'Notes on California Coccidæ, Aleurodidæ and Scolytidæ.'

C. L. MARLATT, Washington, D. C.: 'Economic Entomology in Japan, with Notes on Some of the Principal Insect Pests.'

H. A. MORGAN and J. W. DUPREE, Baton Rouge, La.: 'Life Histories and Hibernation of Mosquitoes.'

HERBERT OSBORN, Columbus, Ohio: (1) 'Notes on Ohio Insects for Season of 1902'; (2) 'A

Method for Mounting dry Coccidæ for Permanent Preservation.'

J. L. PHILLIPS, Blacksburg, Va.: 'Notes on *Melanoplus femoratus*.'

A. L. QUAINANCE, College Park, Md.: (1) 'Further Notes on the Lime, Sulfur and Salt Wash in Maryland'; (2) 'Entomological Notes from Maryland.'

F. WM. RANE, Durham, N. H.: 'Plant Environment and Insect Depredation.'

C. B. SIMPSON, Washington, D. C.: 'Observations on the Life History of the Codling Moth.'

J. B. SMITH, New Brunswick, N. J.: (1) 'Distribution of Broods of the Periodical Cicada in New Jersey'; (2) 'Notes on Experiments with Mosquito Larvicides'; (3) 'Notes on *Culex sollicitans*, its Habits and Distribution.'

T. B. SYMONS, College Park, Md.: 'On the Position of the Setæ of the San José Scale in the Tissues of Infested Plants.'

F. L. WASHBURN, St. Anthony Park, Minn.: (1) 'Distribution of the Chinch Bug in Minnesota'; (2) 'A Criticism Upon Certain Codling Moth Investigations.'

F. M. WEBSTER, Urbana, Ill.: 'A Partial Insect Fauna of *Elymus Canadensis*.'

CLARENCE M. WEED, Durham, N. H.: 'Notes from New Hampshire.'

The following officers were elected for the ensuing year:

President—Professor M. V. Slingerland, Ithaca, N. Y.

Vice-President—Professor C. M. Weed, Durham, N. H.

Second Vice-President—Dr. Henry Skinner, Philadelphia, Pa.

Secretary and Treasurer—Professor A. F. Burgess, Columbus, Ohio.

A. L. QUAINANCE,
Secretary.

THE BOTANICAL SOCIETY OF AMERICA.

The Botanical Society of America held its ninth annual meeting at Washington, D. C., December 30, 1902, to January 1, 1903, under the presidency of Dr. B. T. Galloway.

The address of the past president, Dr. J. C. Arthur, 'Problems in the Study of the Plant Rusts,' was given in the medical building, Columbian University, December 31, 1902. This address has been printed

in the *Bulletin of the Torrey Botanical Club* for January, and reprinted as publication 22 of the society. The program of scientific papers was presented on December 31, 1902, and January 1, 1903.

L. M. UNDERWOOD and M. A. HOWE: 'The Distribution of the Genus *Riella*, with Descriptions of New Species from North America and the Canary Islands.'

F. S. EARLE: 'Types of the Linnæan Genera of Fungi.'

L. R. JONES: 'Pressure and Flow of Sap in the Sugar Maple.'

B. M. DUGGAR: 'The Nutrition of Certain Edible Basidiomycetes.' (Illustrated.)

H. DE VRIES: 'Atavistic Variations in *Onagra cruciata* (Nutt.) Small.' (By invitation.)

J. M. COULTER and C. J. CHAMBERLAIN: 'The Embryo of *Zania*.'

K. GOEBEL: 'Regeneration in Plants.' (By invitation.)

W. A. KELLERMAN: 'Uredinous Infection: Suggestions and Experiments.'

F. M. ANDREWS: 'Contribution to the Physiology of the Cell.' (By invitation.)

W. A. MURRILL: 'North American Species of the Genus *Mison*.' (By invitation.)

W. A. MURRILL: 'The Genera of Polyporaceæ.' (By invitation.)

J. C. ARTHUR: 'Cultures of Uredinæ in 1902.'

F. E. CLEMENTS: 'Herbaria Illustrating Plant-formations.'

H. C. COWLES: 'The Relative Importance of Edaphic and Climatic Factors in Determining the Vegetation of Mountains, with Especial Reference to Mt. Katahdin.' (Illustrated.)

H. C. COWLES: 'Two Distinct Types of Rivers from the Point of View of Physiographic Ecology.'

D. M. MOTTIER: '*Podophyllum peltatum* as an Anomalous Dicotyledonous Plant.'

C. MACMILLAN: 'The Fenestration of *Martensia*.'

D. S. JOHNSON: 'The Development of the Embryo-sac in the Genera of the Saururaceæ.'

A. D. SELBY: 'The Etiolation of Seedlings of *Persea gratissima*.'

ARTHUR HOLLICK: 'A Fossil Petal of *Magnolia* from the Dakota Group of Kansas.'

W. J. GIES: 'Alkaverdin, a Hitherto Unknown Pigment Found in Leaves of *Sarracenia purpurea*.' (By invitation.)

W. J. GIES: 'The Digestive Action Ensuing in the Pitchers of *Sarracenia purpurea*.' (By invitation.)

H. N. WHITFORD: 'Some Studies in Forest Ecology in Northwestern Montana.' (By invitation.)

W. A. CANNON: 'The Cytological Basis of the Mendelian Theory of Hybrids.' (By invitation.)

H. M. RICHARDS: 'The Effect of Wounds on Turgidity.'

R. H. TRUE and W. J. GIES: 'The Physiological Action of Heavy Metals in Mixed Solutions.'

W. J. BEAL: 'What is a Bud and How Long May it Survive?'

F. E. CLEMENTS: 'The Limits of Ecology.'

G. F. ATKINSON: 'The Life-history of *Hypocrea alutacea*.'

B. M. DAVIS: 'The Origin of the Archegonium.'

E. C. JEFFREY: 'Studies on the Cyperaceæ.'

F. S. EARLE: 'Systematic Relations of the Genera of the Agaricaceæ.'

A. M. VAIL: 'A New Species of *Vincetoxicum* from Alabama.' (By invitation.)

A. M. VAIL: 'Notes on the Genus *Rouliniella*.' (By invitation.)

D. T. MACDOUGAL: 'Growth as Affected by Light and Darkness.'

D. T. MACDOUGAL: 'Effect of Etiolation on the Cortex and Periderm of Trees.'

D. T. MACDOUGAL and W. A. CANNON: 'Aerial Propagative Roots of *Globba*.'

B. C. GRUENBERG and W. J. GIES: 'Chemical Studies of Trade Varieties of Logwood.' (By invitation.)

N. L. BRITTON: 'Recent Botanical Explorations in Bolivia.'

A. S. HITCHCOCK: 'Type Specimens of North American Species of *Agrostis*.'

The following associates were elected members: Dr. Charles Joseph Chamberlain, University of Chicago, Chicago, Ill.; Dr. Alexander William Evans, Yale University, New Haven, Conn.; Dr. Duncan Starr Johnson, Johns Hopkins University, Baltimore, Md.

The society now consists of 39 members, 16 associates and 1 patron.

The treasurer's report showed the total assets of the society to be \$3,240, and grants were made as below:

To Dr. Arthur Hollick, \$150, to be used in the prosecution of a study of the fossil flora of the Atlantic coastal plain.

To Dr. J. C. Arthur, \$90, to be used in

defraying expenses extending his researches upon the plant rusts.

To Dr. D. S. Johnson, \$200, to enable him to extend the study of the endosperm and seed in the Piperaceæ and Chloranthaceæ, by means of material to be collected in Central America and the West Indies.

The officers for the ensuing year are:

President—Charles Reid Barnes, University of Chicago, Chicago, Ill.

Vice-President—Joseph Nelson Rose, U. S. National Museum, Washington, D. C.

Treasurer—Arthur Hollick, New York Botanical Garden, New York City.

Secretary—Daniel Trembly MacDougal, New York Botanical Garden, New York City.

Councilors—William Trelease, Missouri Botanical Garden, and Benjamin Lincoln Robinson, Gray Herbarium, Harvard University, Cambridge, Mass.

The above officers, with past president B. T. Galloway, constitute the Council of the Society.

Arthur Hollick and H. M. Richards were chosen to represent the society in the council of the American Association for the Advancement of Science.

This meeting was a most notable one in the history of the society, in the matter of attendance of the members, the number and character of papers presented and in the showing of the general financial strength of the organization. The award of grants as above, constituted the first series given under the newly declared policy of the society.

D. T. MACDOUGAL,
Secretary.

THE AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE.

ELECTION OF FELLOWS.

THE following members were elected fellows at the sessions of the Council on December 31, 1902, and January 1, 1903:

Adams, C. C.

Adler, Isaac P., Physician.

- Allen, Frank, Assistant in Physics, Cornell University.
- Ashley, George H., Professor of Biology and Geology, College of Charleston.
- Austin, Oscar Phelps, Statistician.
- Bagg, R. M., Ph.D., Science Teacher in High School.
- Baker, James H., President, University of Colorado.
- Balch, E. S., Geographer.
- Ball, Elmer D., Professor of Animal Biology, Utah College.
- Barnhart, John H., Bibliographer.
- Bergey, David H., Bacteriology and Hygiene, Assistant in Hygienic Laboratory.
- Bigelow, Maurice A., Instructor in Biology, Teachers College, N. Y.
- Bigelow, Robt. P., Boston, Mass.
- Brackon, Henry M., Physician.
- Brown, S. J., Professor Mathematics, U. S. Naval Academy.
- Browning, Philip Embury, Assistant Professor of Chemistry, Yale University.
- Calvert, P. P., Instructor in Zoology, University of Pennsylvania.
- Campbell, Marius R., U. S. Geologist, Washington, D. C.
- Carroll, James, M.D., Surgeon, U.S.A.
- Chaille, Stanford E., Physician.
- Clements, Julius Morgan, Assistant Professor of Geology, University of Wisconsin.
- Cohen, Solomon Solis, M.D., Professor and Investigator in Scientific Medical Subjects.
- Cook, Samuel R., Instructor in Physics, Case School Applied Science.
- Coplin, W. M. L., M.D., Professor of Pathology and Bacteriology.
- Cowles, Edward, M.D., Alienist.
- Cox, John, Professor of Physics, McGill University, Montreal, Canada.
- Crampton, H. E., Adjunct Professor of Zoology.
- Crile, George W., M.D., Surgeon and Investigator.
- Crook, Alja Robinson, Professor of Mineralogy and Economic Geology, 725 Emerson St., Evanston, Ill.
- Curtis, C. C., Instructor in Botany, Columbia University.
- Curtis, W. E., Journalist and Author.
- Davis, Nathan Smith, M.D., LL.D.
- Davis, W. H., Assistant in Psychology, Columbia University.
- Davy, J. Burt, Instructor in Botany, University of California.
- Dawson, Percy M., M.D., Associate in Physiology.
- Diller, J. S., U. S. Geologist, Washington, D. C.
- Dock, George, Professor of Medicine, University of Michigan.
- Dryer, Charles R., Professor of Geography, High School, Terre Haute, Ind.
- Dunham, Edward K., M.D., Professor of Pathology, Carnegie Laboratory, New York.
- Eiesland, John, Professor of Mathematics, Thiel College, Greenville, Pa.
- Evans, A. W., Physician.
- Focke, Theodore M., Ph.D., Assistant Professor of Mathematics, Cleveland, Ohio.
- Fuller, George W., Consultant in Sanitary Matters.
- Girty, George H., Paleontologist, United States Geological Survey, Washington, D. C.
- Glenn, L. C., Professor of Geology, Vanderbilt University, Nashville, Tenn.
- Green, Bernhard R., Superintendent of Congressional Library Building.
- Griffiths, David, Agrostologist Assistant.
- Hague, James D., Geologist and Mining Engineer.
- Halsted, William S., M.D., Professor of Surgery, Johns Hopkins.
- Hatcher, J. B., Curator, Carnegie Museum, Pittsburgh, Vertebrate Paleontology.
- Haupt, Lewis M., Consulting Engineer.
- Hayes, Charles Willard, U. S. Geologist, Washington, D. C.
- Hillebrand, W. F., Assistant Chemist, U. S. Geological Survey.
- Hiss, P. Hanson, M.D., Instructor in Pathology and Bacteriology.
- Hough, Theodore, Assistant Professor of Biology, Boston.
- Howe, Marshall Avery, Assistant Curator, New York Botanical Garden.
- Hull, Gordon F., Ph.D., Assistant Professor of Physics, Dartmouth College, Hanover, N. H.
- Irving, John D., U. S. Geologist, Washington, D. C.
- Jenney, Walter P., Mining Engineer and Consulting Geologist.
- Keasbey, L. M., Professor of Economics and Politics, Bryn Mawr.
- Kinsley, Carl.
- Kinyoun, J. J., M.D., Bacteriologist in Milford Laboratories.
- Landes, Henry, State Geologist, Seattle, Wash.
- Larkin, Edgar L., Director, Lowe Observatory.
- LeBaron, J. Francis, Civil Engineer.

Lee, W. T., Professor of Geology in College, Trinidad, Colorado.

Littell, Frank B., Professor of Mathematics, U. S. Naval Observatory.

Lyman, Benjamin Smith, Geologist and Mining Engineer.

McKenney, R. E. B., A.M., M.S., Ph.D., Expert in Veg. Phys. and Path., Department of Agriculture; Assistant Professor of Botany, Columbian University.

McLennan, John C., Associate Professor of Physics, University of Toronto, Toronto, Canada.

Martin, G. C., Assistant Geologist, Maryland Geological Survey.

Mead, Elwood, Chief of Irrigation Investigations.

Mendenhall, W. C., U. S. Geologist, Washington, D. C.

Miyake, Kuchi, Investigator.

Moenkhaus, W. J., Teacher and Investigator of Zoology, Bloomington, Indiana.

Moore, Eliakim H., Head Professor of Mathematics, University of Chicago.

Moore, P. M., Geologist and Mining Engineer, St. Louis, Mo.

Nelson, Aven, Professor of Biology, University of Wyoming.

Newsom, J. F., Stanford University.

Olive, Edgar W., Instructor in Botany, Harvard University.

Ortmann, A. E., Curator Invert. Pal. Museum, Princeton University.

Park, William H., M.D., Bacteriologist, New York Department of Health.

Parker, Edward W., Statistician, U. S. Geological Survey.

Perrine, C. D., Astronomer, Lick Observatory.

Pond, C. G., Professor of Chemistry, State College, Pa.

Putnam, Mrs. M. L. D., President of Davenport (Ia.) Academy.

Quaintance, A. L., State Entomologist, College Park, Md.

Ransome, Frederick Leslie, U. S. Geologist, Washington, D. C.

Rhodes, Edward, Instructor in Physics, Haverford, Penn.

Richardson, Miss Harriet, Connected with Smithsonian Institution.

Richardson, Mark Wyman, M.D., Engaged chiefly in laboratory work in clinical medicine, Boston, Mass.

Sachs, B., M.D., Clinical Neurologist, New York.

Schuchert, Charles, Paleontologist, U. S. National Museum, Washington, D. C.

Smallwood, W. M., Ph.D., Associate Professor of Zoology, Syracuse, N. Y.

Strong, Oliver S., Biologist and Neurologist, Columbia University, New York.

Thayer, William S., Associate Professor of Medicine, Johns Hopkins University.

Tyrrell, J. B., Mining Engineer.

Tyson, Dr. James, Professor of Medicine.

Weed, W. H., U. S. Geologist, Washington, D. C.

Wheeler, Alvin Savage, Ph.D., Associate Professor of Organic Chemistry, University of North Carolina, Chapel Hill, N. C.

Williston, Dr. Samuel W., Paleontology.

Winslow, Charles E. A., Instructor in Biology.

Witmer, Dr. L., Assistant Professor of Psychology, University of Pennsylvania.

Woods, Dr. James Houghton, Instructor, Harvard University.

Wyeth, Dr. John A., Surgeon.

Wyman, Dr. Walter, Surgeon-General, Marine Hospital Service.

SCIENTIFIC BOOKS.

Quantitative Classification of Igneous Rocks, based on chemical and mineral characters with a Systematic Nomenclature. By WHITMAN CROSS, JOSEPH P. IDDINGS, LOUIS V. PIRSSON and HENRY S. WASHINGTON; with an introductory review of the development of Systematic Petrography in the nineteenth century, by WHITMAN CROSS. The University of Chicago Press. 1903. Pp. 286.

During the past year there have appeared in the *Journal of Geology* a series of papers dealing with the various aspects of petrographical classification. These, which really form parts of a continuous treatise, have been gathered together in the present volume. A series of tables and a glossary have been added, the whole forming one of the most valuable contributions to systematic petrography which has as yet appeared.

Few sciences have shown a more rapid development than the science of petrography. One hundred years ago the distinction had not been drawn between a rock and a geological formation, and many very fine-grained rocks were regarded as minerals and were described as such. Thus basalt was supposed to be a mineral species and its columnar

structure was thought to be a peculiar type of hexagonal crystallization. During the early years of the last century progress, it is true, was comparatively slow, but with the introduction of the microscope the science received a tremendous impetus and a great number of enthusiastic workers were attracted to it, so that during the past thirty years or more an immense store of facts has been collected. The system of petrographical classification, however, which has been gradually elaborated, while never wholly satisfactory, is now proving inadequate and unwieldy. It fails, moreover, to express the chemical relationship of rocks. Every year a host of new names, having in themselves nothing to indicate the character of the rocks which they designate, are being introduced and applied to new types or varieties, and the confusion promises to increase with the advance of our petrographical knowledge.

An able historical summary of the development of petrographical classification is given by Cross in the introduction to the volume under consideration, and a new system of classification for the igneous rocks is then presented, based on thoroughly scientific principles and capable of indefinite expansion so as to meet all requirements of the science as it develops. There is no attempt made in the new system to remodel any existing system of classification so as to meet present needs. As the authors state, it would be impossible to do this satisfactorily. An entirely new classification is presented with an entirely new nomenclature—a nomenclature, however, based on mnemonic principles so that it can be grasped and remembered with comparatively little effort.

Before passing to the examination of this new classification, however, it must be pointed out that the authors really present two systems of classification for the use of geologists—a simple or general classification for use in the field, based altogether on the megascopic characters of rocks—and a second much more elaborate and detailed classification which is to be employed after a more complete study of the rock has been made. These two systems are in agreement with each other, the second

forming in a way an extension or elaboration of the first. The classification for field purposes retains the common names now in general use, granite, syenite, diorite, basalt, melaphyre, etc., although in some cases giving the terms a rather more comprehensive meaning than they have at present. Thus syenite is made to include all coarse-grained igneous rocks, rich in feldspar, the feldspar, however, being either orthoclase or plagioclase. The term thus embraces, in addition to the normal syenites, the anorthosites, as well as the more feldspathic monzonites, diorites and gabbros of the present classification. However, it may be said that, so far as the field geologists are concerned, the general classification proposed will not differ from that at present in use to such an extent as to cause any inconvenience in applying it. For them, in fact, petrographic classification is made distinctly easier.

The more detailed classification is based on the chemical composition of the rocks, all rocks of a like chemical composition being grouped together. The rock is thus classified according to the composition of the magma from which it solidified. The classification is, furthermore, *quantitative*, and is thus admirably adapted for purposes of comparison and for studies in rock differentiation, which are playing so important a part in modern petrographical work. A chemical analysis or a microscopical examination of the rock is required before its place in this classification can be determined—except in a very general way.

The chemical composition of the rock being known, its mineral composition is first calculated. This is readily and quickly done by the aid of the valuable tables appended to the book. Since, however, the same magma may, under different conditions, crystallize out in different mineral combinations, a certain clearly defined method is followed in these calculations, giving that grouping of minerals which the magmas on cooling usually develop. This percentage mineral composition of the rock expressed in these standard minerals is called the *norm*, a mineral composition which the magma would normally

assume. If for any purpose we wish to calculate the percentage mineral composition of the rock, giving the exact proportion of minerals actually present, full explanations as to the method to be followed are also given, this constituting the *mode* of the rock, or the manner in which the chemical elements have actually arranged themselves. As a general rule, the *norm* and the *mode* of a rock agree closely.

No classification, however, which requires a chemical analysis of a rock before the position of the rock can be determined and a name given to it, would be susceptible of general use. Consequently a method is indicated by which it is possible to determine the chemical composition of a rock without the aid of such an analysis. Rosival has recently shown that if a few thin sections of a rock are taken, the relative proportions of the various minerals constituting the rock may be determined by measuring under the microscope the diameters of each crystal in lines running arbitrarily across the thin sections in question, care being taken to measure a distance at least 100 times as great as the average diameter of the constituent grains. The values obtained will correspond to those of the volumes of the several minerals present. The relative weights of the several minerals may be deduced from these volumes by multiplying each by the specific gravity of the mineral and reducing the whole to 100 parts.

The approximate chemical composition of the several minerals can be determined from the known composition of these species in similar rocks, and from these data the composition of the rock as a whole can be easily calculated. From this, in its turn, the *norm* may be obtained.

In the case of glassy rocks or those containing a large amount of unindividualized material, a chemical analysis is necessary, just as it is for that matter in many cases in the system of classification now employed.

The *norminative* mineral composition and the chemical composition of the rock being thus ascertained, its position in the classification can be readily determined. For this purpose the rock-making minerals are divided

into two groups, namely, those which are characterized by a high content in silica, aluminium and alkalis, and those characterized by a high content of iron and magnesia. The first group is known mnemonically as the *salic* (silica-alumina) group and the second as the *femic* (ferro-magnesian) group. On the relative proportion of the minerals of these two groups present, rocks are divided into five *classes*, according to whether one or other of these groups is *extremely abundant* or merely *dominant*, or whether the minerals of the two groups are present in about equal proportions. These five classes are thus characterized (commencing with the most *salic*) as the *persalane*, *dosalane*, *salfemane*, *dofemane* and *perfemane*. These classes are subdivided into *orders* according to the relative proportions of minerals forming the predominant group in each case. Thus in the preponderatingly *salic* classes the order will be based on the relative amount of quartz, feldspars and feldspathoids. The orders in their turn are subdivided into *rangs* (an archaic equivalent of *ranks* used to avoid confusion with this latter term), on the ground of the chemical character of the bases in the minerals of the preponderant group in each case; thus, if these were feldspathic, the fivefold division would be made according to the proportion of alkalis to lime in the feldspars. The lowest division, known as a *grad* (an archaic form of *grade*), is based on the relative amounts of the minerals composing the subordinate group in the rocks. In addition to these, further subdivisions are provided for, when necessary, by *subclasses*, *suborders*, *subrangs* and *subgrads*.

The system demands an entirely new nomenclature; in fact any attempt to adapt the old nomenclature to the new system would result in the direst confusion. A new nomenclature in its entirety has accordingly been elaborated, but, being based upon a definite plan, is easily grasped after a little practice. Each name consists of a root derived from some geographical name, the name of some locality where the rock in question is typically developed, the localities being chosen impartially from all countries, thus giving an inter-

national complection to the scheme. To this root is added a suffix which varies in a definite way so as to indicate class, order, rang and grad. For these respective divisions, the letters *n, r, s, t* are employed, in conjunction with the vowel *a*, thus giving in English, *ane, are, ase* and *ate*. In *subclass, suborder*, etc., the vowel is changed to *o*, thus giving *one, ore, ose* and *ote*. An example of the working of the system may prove of interest.

In many parts of the world in recent years occurrences of a peculiar syenite have been found, the rocks being rich in alkalis and usually light in color. They sometimes contain a little nepheline; in other cases this mineral is absent. A number of names have been given to local varieties of this rock, *pulaskite, nordmarkite, lauvikite*, etc. When any new occurrence is described an attempt is made to bring it under one or other of these terms, or perhaps a new varietal name is suggested. How many of these varieties, often more or less overlapping one another in their characters may eventually be named, it is at present difficult to say.

Now, under the proposed system, the *norm* of any new occurrence having been ascertained, it would at once be seen that the rock belonged to the class *persalane*, for the feldspars would form almost the entire rock. Then it would be found that the quartz or nepheline present occurs in very small amount, less than one seventh of the feldspar. This would bring the rock into the fifth *order* of the *persalanes*, namely, the *canadares*. The question as to the proportion of the alkalis and the lime in the rock would then present itself. If this proportion be more than seven to one, the rock belongs to the first *rang* of the *canadares* and is a *nordmarkase*. If, further, the soda is dominant over the potass, being present in the proportion of between three fifths and one seventh, the rock belongs to subrang 4 and is a *nordmarkose*. If the relative proportion of lime to alkalis be greater than one to seven, the rock falls into rang 2 and is a *pulaskase*—and, the relative proportion of soda and potass remaining as above, into the *subrang lauvikose*.

It will thus be seen that it is possible to com-

pare accurately the newly described variety with those types already established and to classify it with that with which it is most nearly identical. The name assigned to it, moreover, shows at once just how and to what extent it differs in composition from any and each of the varieties already known.

As will be seen, the volcanic or plutonic character of the rock (so important in the schemes of classification employed by Rosenbusch or Zirkel) has not been taken into consideration in naming the rock. A qualifying adjective, however, is prefixed to indicate the texture of the rock, which is, as a general rule, determined by its solidification at the surface or in the depths of the earth's crust. The qualifying adjectives employed are those now in general use, viz., *granitic, trachytic, ophitic, porphyritic*, etc. This, added to the magmatic name, will give a compound name which accurately describes not only the composition, but the texture of the rock.

It is impossible to refer to more than the main outlines of this new scheme of classification, but, as will be found by perusal of the book, the whole question has been most carefully thought out, every possible case considered and the scheme tested by applying it to thousands of rock analyses. It, further, has the merit of being presented in clear and idiomatic English, so that it can be readily understood. It is the result of some ten years' work on the part of four of the ablest petrographers in America, during which time many different methods of classification have been successively drawn up and tested, only to be found to break down in some important particular. The present scheme is thus the result of a long course of investigation and very mature deliberation. With a little experience the calculations required for the application of the system can be quickly made, especially with the aid of the tables given in the book for that purpose. By such calculations, furthermore, it is possible to check the accuracy of the chemical analysis of the rock and in many cases to point out the nature of errors, if any have been made. A higher degree of accuracy is thus secured in petrographical investigation.

It is hardly to be expected that an entirely new classification such as that proposed will at once be universally adopted, but it is believed that as time goes on it will recommend itself more and more to petrographers as a *quantitative* system of classification, much more precise and definite than any that has been hitherto proposed, and having the further advantage of being based on thoroughly scientific principles and capable of indefinite expansion, if necessary, to meet the growing needs of the science. FRANK D. ADAMS.

MCGILL UNIVERSITY, MONTREAL.

Ueber das Hirngewicht des Menschen. By F. MARCHAND. Abh. d. math.-phys. Classe d. Königl. Sächsischen Ges. d. Wissensch., Bd. XXVII., 1902, No. IV., pp. 393-482.

Professor Marchand, of Marburg, has accumulated the largest number of human brain-weights ever published, and in a large series of tables, containing 1,169 cases, he gives a thorough analysis of these data. Marchand discusses the influences affecting the weight of the brain, such as the cause of death, bodily stature, sex and age. He finds a notable increase in the brain-weight of persons dying of diphtheria and other acute diseases, owing, no doubt, to the hyperæmia and œdema of this organ. In new-born children the average weight is 380 grams for males and 353 grams for females. Combining with these the infants less than one week old, the averages are 371 grams for males and 361 grams for females. These weights are doubled by the end of the first year, and tripled at the end of the third. After the fifth year the increase in the weight of the brain is more gradual. The figures show that in most persons the maximum brain-weight is attained at about the twentieth year in males, the average being about 1,400 grams, and at about the seventeenth year in females, the average being 1,275 grams. The reduction of the average brain-weight due to senile atrophy occurs in the eighth decade in men and in the seventh decade in women. The maximum absolute weight in Marchand's series was 1,705 grams in a male. Many high brain-weights were omitted from the

tabulations on account of hydrocephalus, brain-tumor, meningitis and other brain affections. Low brain-weights, less than 1,200 grams in males and less than 1,100 grams in females, constituted about five and seven per cent., respectively, of all the cases, usually in phthisical subjects or in those dying of wasting diseases. The tables show a certain relation existing between the stature and brain-weight, but the ratio of increase is a very inconstant one. Finally Marchand discusses the relation of the sexes as to their brain-weight, and concludes that the lesser weight of the brain in women is not alone dependent upon her smaller stature, for a comparison of both sexes of the same stature shows the male brain to be invariably the heavier. In the growing child, until a stature of seventy centimeters is attained, the brain-weight increases proportionately to the increase in body-length, irrespective of age or sex; thereafter, however, the male brain begins to outstrip that of the female. Woman's lesser brain-weight, like her lesser head-circumference, as compared with males of the same stature, seems to be an expression of the different organization of the female body.

E. A. S.

SCIENTIFIC JOURNALS AND ARTICLES.

The Popular Science Monthly for February has for frontispiece a portrait of Carroll D. Wright, president of the American Association. Asaph Hall has an article on 'The Science of Astronomy,' in which attention is called to the influence of science in promoting harmony among nations. Bradley M. Davis discusses 'The Evolution of Sex in Plants,' as illustrated by the Algæ. Alverton W. Price shows 'The Economic Importance of Forestry,' and Frederick A. Woods gives the seventh of his papers on 'Mental and Moral Heredity in Royalty,' this one dealing with the house of Nassau and Brunswick. An account of 'The Smithsonian Institution' is reprinted from its last report. Roger Mitchell discusses 'Jewish Immigration,' showing that it presents a somewhat serious problem in New York. Wesley Mills treats of 'The Behavior of Blind Animals,' adducing instances to show how great

is the effect on the disposition of the animals, and George M. Sternberg tells of the history and possibilities of 'Preventive Medicine.' Finally, J. McKeen Cattell presents 'A statistical Study of Eminent Men.'

The Plant World for January starts a new volume in a new dress, with a cover in two colors designed by Mr. Shull. Having changed its publisher and been copyrighted, it will henceforth appear promptly. It contains 'Obtusilobata Forms of Some Ferns,' by C. E. Waters; 'The Preservation of Our Native Plants,' by Ruth E. Messenger; 'Dimorphism in the Shoots of the Ginkgo,' by G. N. Collins; and numerous short articles and notes. 'The Families of Flowering Plants,' which has been running for three years as a supplement, has been completed, and for the present four pages are added to the size of the journal.

The Zoological Society Bulletin for January contains a description of the recently completed lion house in the New York Zoological Park with notes on its contents, which were mainly presented by friends of the society. A list of the more interesting animals includes a pair of snow leopards, another of Prejvalsky horses, a cape hunting dog (*Lycaon*) and a Tasmanian wolf. This last is the second specimen brought to this country alive, the first being in the National Zoological Park. It is rather surprising to learn that the cheetah is now rare in captivity, at least outside of India. The number contains a brief account of the New York Aquarium and its work.

The Museums Journal of Great Britain for January has an account of the Dutuit Bequest to Paris, which comprises, besides other art treasures, many rare and beautiful books. The collection has been in process of formation since 1832, and had been so well cared for that many of the specimens had never been unpacked. Among the many notes is recorded the formation for the Sydney Museum, New South Wales, of a collection of colors and chemicals used in color making, with samples of fabrics dyed with them.

SOCIETIES AND ACADEMIES.

PHILOSOPHICAL SOCIETY OF WASHINGTON.

THE 32d annual meeting was held December 20, 1902. A new code of by-laws was adopted, the principal change from the old code consisting in the statement of the powers of the general committee in conformity with the statute under which the society is incorporated, and the establishment of an executive committee to care for routine business.

The report of the secretaries showed a present active membership of 110, a net gain of 2 during the year; besides the annual meeting 16 meetings have been held, with an average attendance of 37; 38 papers were presented.

The treasurer's report showed a gross income of about \$950 and expenditures of \$460.

Professor J. H. Gore, of the Columbian University, was elected president for the ensuing year; Messrs. Hagen, Marvin, Littlehales and Abbe were elected vice-presidents. The treasurer, Mr. Green, and the secretaries, Messrs. Hayford and Wead, were reelected, and the following were elected on the general committee: Messrs. De Caidry, Paul, Winston, Watkins, Briggs, Fischer, Bauer, Day and Harris.

The meeting regularly falling on January 3, 1903, was ordered omitted on account of the meetings of the American Association for the Advancement of Science during the week on which that date fell.

THE 561st meeting was held January 17, 1903, with the new president, Professor J. H. Gore, in the chair.

The evening was devoted to reports from the committee on mathematical science.

Professor Cleveland Abbe, of the U. S. Weather Bureau, spoke of the German Mathematical Union and the new 'Encyclopædia of Mathematics.' The Mathematical Union or Association originated as a branch of the Association of German *Naturforscher und Aerzte* at the Heidelberg meeting of 1889, and its duties were definitely formulated at the Bremen meeting in September, 1890. It now numbers about 550 members; it has published two or three miscellaneous volumes, such as a list of German mathematical theses by can-

didates for the degree of Ph.D., and the catalogue of mathematical apparatus, by Professor Walter Dyck. Its principal publication has been eleven volumes of 'Annual Reports,' containing elaborate reviews of progress in the various branches of mathematics and its applications. In 1894, at the Vienna meeting, the publication of a 'mathematical lexicon' was decided upon, but at the Frankfort meeting of 1896 it was concluded best to combine this idea with the 'Encyclopædia of Mathematical Sciences,' undertaken by Professor W. F. Meyer, of Clausthal, and Professor H. Burkhardt, of Zurich. The mathematical union has, therefore, united with the Scientific Association of Göttingen and the academies of science at Munich and Vienna in becoming responsible for this latter work. It was originally estimated that the encyclopædia would consist of seven volumes in ten distinct parts besides the general index, but the portions already printed show that the whole work will be larger than was expected. The publication has proceeded by parts as follows: 1898, one; 1899, four; 1900, three; 1901, three; 1902, four. These parts are scattered through the encyclopædia as follows: Volume I., seven parts and completed; II., four parts; III., one part; IV., three parts. It may, therefore, be expected that five or six years will still elapse before we shall approach the end of this great work.

Mr. Abbe exhibited the fifteen parts already received, and they were examined in detail by the audience. He remarked upon the chapters treating of the theory of numbers; that on mathematical economics; the memoirs on differential equations; the chapter on mathematical apparatus and machinery, and especially the two memoirs by Professor A. E. H. Love, of Oxford, on the physical basis and the theoretical development of hydrodynamics.

Professor Frank H. Bigelow, also of the Weather Bureau, summarized the 'Applications of Mathematics in Meteorology.' Meteorology has suffered in the past by the misapplication of mathematical theories to the explanation of cyclones and anticyclones, and also of the general circulation. It has been

shown that Ferrel's vortex and Oberbeck's vortex do not agree with the modern observations of the local circulation of the air; also, that the theories of these authors must be greatly modified to fit the facts of the movements of the atmosphere in general. Similarly, there has been a tendency to misapply the theory of least squares, and the probability curves, in discussing the periodic cycles observed in the solar and terrestrial atmospheres. These theorems require that the events shall be independent of one another, but in such thermodynamic circulations this is not the case.

The next paper was 'On the Foundations of Geometry and on Possible Systems of Geometry,' by Dr. Henry Freeman Stecker, of Cornell University. In the absence of Dr. Stecker his paper was presented by Mr. Radelfinger.

After an introduction on the assumption which must be made in constructing a geometry, Dr. Stecker reviewed the criticisms of Moore and Schur of Hilbert's classic paper of 1899, recently translated, and announced the conclusions that in spite of all criticisms and attempted improvements Hilbert's system has 'withstood all attacks and remains not only apparently sound in logic, but the simplest of such systems as have thus far been constructed.'

An account was next given of Hilbert's second, and recent, great memoir, *Math. Annalen*, Bd. 56, which has for its object to establish Lie's well-known and indispensable results, without the assumption, made by Lie, that the functions defining the displacements are differentiable. In solving the problem Hilbert makes use of Cantor's theory of point-assemblages and Jordan's theory of a closed curve free from double points. Hilbert's results, so far as they go, establish the independence of Lie's results of the assumption stated above, but they have yet to be extended to elliptic geometry and also to space.

In conclusion, a thesis by Hamel, a pupil of Hilbert's, was discussed, which leads to the conclusion that 'from the standpoint of the calculus of variations the Euclidean geometry is the simplest possible.'

A fourth paper, by Mr. F. G. Radelfinger,

'On the Analytic Representation of Functions,' was postponed till a later meeting.

CHARLES K. WEAD,
Secretary.

THE TORREY BOTANICAL CLUB.

THE club held its regular annual meeting for election of officers at the College of Pharmacy Building, January 13, Dr. Rusby in the chair. The following officers were elected for 1903:

President—Hon. Addison Brown.
Vice-Presidents—Dr. H. H. Rusby and Professor E. S. Burgess.
Treasurer—Professor F. E. Lloyd.
Recording Secretary—Mr. F. S. Earle.
Corresponding Secretary—Dr. John K. Small.
Editor-in-Chief—Dr. John H. Barnhart.
Associate Editors—Dr. N. L. Britton, Dr. T. E. Hazen, Dr. M. A. Howe, Dr. D. T. MacDougal, Dr. W. A. Murrill, Dr. H. M. Richards and Miss Anna Murray Vail.

The treasurer reported a favorable balance in the treasury. The editor reported that 1902 had been the most productive year in the history of the club both in number of pages printed and in plates. An increase of fifty per cent. in the outside subscriptions to *Torrey* was reported, making this publication practically self-supporting. F. S. EARLE,

Secretary.

THE AMERICAN BOTANICAL CLUB.

DURING the latter half of the year 1902 a new organization known as The American Botanical Club has entered the field of botany. While yet in its infancy, the club has met with remarkable success, having at the close of 1902 an enrolled membership of seventy-six, covering a large portion of the country.

While very liberal in its scope, so as to admit the less advanced students, the club has undertaken an important work by the encouragement of the study of plant life and the preparation of members for deeper research.

Officers for 1903 have been elected as follows:

President—Willard N. Clute.
Vice-Presidents—Miss Pauline Kaufman and Miss Angie M. Ryon.
Secretary—J. C. Buchheister.
Treasurer—Frank A. Suter. F. A. S.

THE BERZELIUS CHEMICAL SOCIETY.

THE 81st meeting of the Berzelius Chemical Society was held in the Agricultural Department Laboratory, Raleigh, N. C., Wednesday afternoon, January 28, 1903. The program was filled by Messrs. C. B. Williams and F. C. Lamb.

Mr. C. B. Williams presented a very interesting abstract of a report of work recently done at the Imperial University of Japan, on 'The Occurrence of Manganese in Plants,' pointing to the conclusion that this element plays a far more important part in plant nutrition than is usually supposed.

A paper was read from Mr. F. C. Lamb, which embodied work recently done by Mr. Lamb in behalf of the Department of Agriculture in the investigation of 'Condimental Stock Foods.' From the work done it is plainly evident that the claims made by the manufacturers of these condimental powders are in most cases perfectly absurd, and the prices charged exorbitant. The powders examined were found to be composed almost entirely of the simple home remedies which have been used by every country 'horse doctor' from time immemorial.

The following officers have been elected for the ensuing year:

President—C. B. Williams.
Vice-President—W. G. Haywood.
Secretary-Treasurer—J. S. Cates.
Abstractors—G. S. Fraps, S. E. Asbury, P. R. French, F. C. Lamb, W. A. Syme, J. M. Pickell, W. G. Haywood and C. B. Williams.

J. S. CATES,
Secretary.

THE ONONDAGA ACADEMY OF SCIENCE.

THE academy met on January 23 and elected the following officers for the coming year:

President—Dr. E. H. Kraus.
Vice-President—John D. Wilson.
Secretary—Philip F. Schneider.
Corresponding Secretary—Dr. T. C. Hopkins.
Treasurer—Miss Louise W. Roberts.
Librarian—Mrs. L. L. Goodrich.

At the meeting on December 21, Dr. M. W. Smallwood gave an illustrated lecture on the dinosaur fields of Wyoming, based on his visit to that region two years ago. He showed

many interesting views of the dinosaur bones, the quarries and the scenery of the region in which they occur.

T. C. HOPKINS,
Corresponding Secretary.

DISCUSSION AND CORRESPONDENCE.

THE FALL OF BODIES.

THE report of Professor E. H. Hall on the motion of falling bodies recalls an interesting experiment. It was proposed by Newton in order to obtain a proof of the rotation of the earth. The experiment was made by Robert Hooke in 1680. Hooke dropped a ball 27 feet, and it fell toward the east and south. The most complete experiments have been made in Germany. Benzenberg dropped balls 235 feet, and found a small deviation to the south and a marked deviation to the east. His first sixteen trials gave a deviation to the north, but the last fifteen trials more than balanced this. Two years later Benzenberg repeated his experiments, and found a small deviation to the north. It appears to have been the erroneous investigation of this question by Olbers that led Gauss to examine the theory of this motion. Gauss says that, to his astonishment, he found by theory no deviation to the south. Afterwards Laplace examined this question ('Mec. Cel.,' Tome IV.) and found no deviation to the south. The most complete experiment is that of Professor Reich, who dropped balls 488 feet. From 106 trials the deviation to the east was 23.30 mm., and to the south 1.06 mm.

The result appears to be that the deviation to the east is decided, and that to the south or north is so small that it can be ascribed to errors of observation. The probable errors of the results are large. Perhaps good conditions for this experiment can be found in our country.

A. HALL.

February 4, 1903.

MOUNTAIN SPECTRE NEAR BOULDER, COLORADO.

THE term 'mountain spectre' is taken from the Encyclopedia Britannica, where it is noticed under the article 'Halo.' The best-known example is at the Brocken in the Harz Mountains. From the description of the phenomenon as observed at that place, it is in-

ferred that the appearance noted in Colorado was quite as distinct as that at that famous locality. It was observed February 1 from the top of Green Mountain, near Boulder, Colorado. This mountain is a high point in the foothill belt; its summit is 2,500 feet above the plains which it overlooks, or about 7,800 feet above the sea. On the day mentioned, at 4:30 P.M. patches of white cloud were drifting below its summit. Occasional snow flurries visited the plains below. The temperature was apparently below the freezing-point. At the hour of observation the sun, which was not more than twenty degrees above the horizon, was shining clear at the summit. Opposite the sun, a few hundred feet distant, was a mass of white or grayish cloud. Upon this cloud was seen a complete circle of rainbow colors. The diameter of the most pronounced red ring was estimated at nine degrees. Outside of this was a faint blue color, and then a suggestion of red in a still larger circle. Within the nine-degree red ring were blue and violet, the center appearing a dull lavender. In the field within the bright red ring appeared the shadow of the observer, which was so definite as to reproduce all movements of arms and hands. Each observer saw his own shadow and the reproduction of his own movements, and could see nothing of the shadow or movements of his neighbor if standing more than six or eight feet away. The phenomenon was watched about twenty minutes.

N. M. FENNEMAN.

UNIVERSITY OF COLORADO.

SIGNS OF THE GLACIAL PERIOD IN JAPAN.

IN my visit to Japan a few years ago I failed to find any distinct signs of glacial action, though I penetrated what seemed to be a typical place for extinct glaciers in the mountainous region one hundred miles northwest of Tokyo. But Mr. Yeijiyo Ono, of the Bank of Japan, has just sent me a translation from a Japanese paper of some observations in the mountainous district a little farther south than that visited by me, which would seem to indicate that there are some relics of the glacial period in the central highlands

of Japan. The translation is interesting, not only as settling a fact of importance, but as indicating the alertness of the Japanese mind in prosecuting scientific inquiry. The article is from the *Zigi-shimpo* of November 5, 1902.

G. FREDERICK WRIGHT.

OBERLIN COLLEGE,
February 4, 1903.

Nobody has ever found a trace of a glacier in our country, and in fact it has often been doubted that one existed in Japan. Professor Milne, of England, who once held a chair in the Imperial University of Tokyo, even went so far as to deny its existence in Japan. It is, therefore, interesting to learn that Professor Yamazaki, of the Higher Normal School of Tokyo, recently found a trace of one on a mountain side in Shinano. When he was interviewed, he gave the following accounts of his discovery:

"The fact that America and Europe were once covered with ice is now beyond dispute; and recently we heard that traces of a glacier were found in Australia; and I have always held a theory that Japan is qualified to have a glacier, for the following reasons.

"1. There are several mountains as high as and above 3,000 meters.

"2. Many of them are covered with perpetual snow.

"3. The climate, being 'oceanic,' the amount of rain and snow is greater here than it is in Europe.

"4. In America, I found that the glacier region comes as far south as the lowest extremity of 37° 60' N. L. Now, Tokyo being on 35° 41' N. L., the middle part of the island along the coast of the Japan Sea corresponds with the glacier region in America.

"I had held this as a mere theory until last August, when I actually found traces of a glacier in one of the northwestern mountains.

"Last August, as a Committee on the 'Prevention of the Earthquake Disasters,' I climbed up a volcano, located on the boundary of three countries, Shinano, Yetchu and Yechigo; and when making investigations in Hida range, I actually fell upon a trace of a glacier on the side of Shira-Umaga-Take. This place, which is 2,900 meters above the

sea, forms a sort of valley, extending, say, for about 200 yards, and the layer of snow is about 20 yards deep. The sides of the valley are composed of slate-rock and sand. Pebbles and pieces of rock found on the mountain are unlike those which we generally find in ordinary mountains—smooth and striated. The rocks along the snow line are marked with grooves and the rock-floor is marked by the grinding work done by a glacier. In a still lower part of the valley, further down, I found stones and rocks traversed in every direction. I have found sufficient evidence to form a belief that here we have the proof of the existence of a glacier in Japan. The erosion is effected by the ice pressing against the sides, as it crept along, taking sand and stones which fell from the sides. If we should follow the range up to the province of Hida, I believe, we should find more valuable proof of the existence of glaciers. At any rate, we certainly have sufficient proof now for clearing the doubt of the existence of glaciers in this country.

"It is a strange coincidence, but a few days later, Professor Yabe found a zone of vegetation like that of the Alps and Chishima, in the very same place."—As he was interviewed by the editor of *Zigi-shimpo*.

November 5, 1902.

SHORTER ARTICLES.

TYPES OF PRE-LINNEAN GENERA.

INSTABILITY in the application of generic names is undoubtedly the most serious remaining deficiency of our current systems of biological taxonomy. To secure stability of specific names a definite rule of priority was sufficient because it had occurred to nobody to deny that the specimen first named and described should constitute the type of the species and determine the application of the specific name. With genera also stability is not to be secured merely by observing priority of dates, since it is necessary that writers agree upon the application of a name as well as upon its age; but by treating each generic name as inseparably attached to a single species as its nomenclatorial type, the law of

priority is rendered as effective with genera as with species.

Many systematists have been content to follow in a general way the varying nomenclatures of their predecessors, while others who have appreciated the importance of uniform procedure have experimented with what has been called the method of residues or elimination, under which a generic name is inherited by the last species left in the genus after all possible segregations have been made. This plan is defective in theory, very difficult of application, and does not bring about uniformity in practice, because different systematists commonly differ as to which species were rightly removed from the genus, and consequently as to which in reality remained to the last. Those who look upon stability as the prime requisite of a system of formal nomenclature are accordingly beginning to abandon elimination in favor of the selection of types by a definite method of priority, but progress in this desirable direction is greatly retarded by the fact that the rule which recognizes 1753 as the beginning of binomial nomenclature would have the unforeseen and very undesirable result of associating many old and well known generic names with species for which they are not currently used, that is, if it were not possible to find a means of avoiding the difficulty.

It seems certain that the consistent application of any method will result in many changes of names, since even in instances where genera were established for single species their names have frequently been slipped along to groups of plants quite unknown to the original authors. Rather than run the risk of having to use old names in new and unexpected places, some would give over the attempt at securing stability. But to those who perceive that taxonomic study is largely a waste of time unless it can be carried on under rules which guarantee uniform nomenclatorial results, no changes essential to the application of such an improved method will seem intolerable or ridiculous, though to make unnecessary changes, even to carry into effect a good rule, would be foolish. Because the guinea-pig would become *Mus* and the

giraffe *Cervus* is not a reason why we should not, in general, treat the first species as the type of its genus; it is simply a reason why we should find, if possible, a means by which an undesirable incident may be avoided without losing the important advantage of a method which all can apply with uniform results. The plan of treating the generic names adopted from pre-binomial writers as a special case should not be opposed even as an exception to the general rule, since with these we are not dealing with the normal method of establishing genera, but are attempting to arrange as smooth a connection as possible between two periods of botanical history. It is true that we are not following the intent of eighteenth-century authors, since we now think of generic names as attached to species rather than to definitions or concepts, but this should not make us unwilling to preserve as many of the older names as possible, nor careless in applying them as nearly as possible in accordance with historical usage.

Many of the older generic names which would be transferred by taking either the first or the last Linnæan species as type may be kept in their customary places by selecting as types species having such names as *officinalis*, *utilis*, *communis*, *vulgaris*, *verus*, *typicus* or others indicative of botanical prominence or popular interest. A rule containing a list of such names would facilitate the selection of types and would be open to no charge of indefiniteness.

Another practical suggestion is that instead of taking as types the first species placed by Linnæus under names adopted from pre-binomial writers, we take the species under which Linnæus gives the oldest citation under the same generic name. This would place the question of types on a definite basis of chronology, and opens no doors to individual differences of opinion. It would require considerable bibliographic labor to locate the oldest citation under some of the larger genera, though this task is much more simple and direct than the method of elimination. The utility of such a rule for the purpose for which it was intended will depend, however, on whether Linnæus followed a method of

citation of such consistent historical thoroughness that his oldest references generally fall on the oldest and best known species of each genus. The indications are that he did not, but often gave citations to old books under relatively little known species which were not well represented in the writings of his more immediate predecessors.

If this should prove to be the case we would save names as well as labor by beginning our historical investigations with Tournefort, who was generally careful to place the most common and best known species at the head of his list. Moreover, such a limitation would enable us to frame a rule of much more direct and easy application, for instead of being obliged to compare the chronology of the Linnæan species of a genus we could simply look for its type where the name first appeared in Tournefort's 'Institutiones' or some later work. If it were found that this species had been included as a binomial in the 'Species Plantarum,' or wherever the generic name was first used by a binomial author, this would constitute the adoption of the pre-Linnæan genus, and its type species would have been determined historically, but still in an entirely definite and invariable manner. Such a rule might read something as follows:

A genus is treated as having been adopted from Tournefort or a later nonbinomial writer when its type species was included under the first binomial use of the name.

This rule would have the further distinct advantage that generic names borrowed by Linnæus from older literature, but applied to new groups of plants, would not be disturbed, since their pre-Linnæan types would not be found under the Linnæan use of the name, which would then be treated as though it had originated with Linnæus or any later botanist. Generic names, like those of species, would have a definite order of priority under the binomial system of nomenclature. All the real advantages of beginning generic nomenclature with Tournefort would be secured, without the folly of resurrecting the many generic names which did not come into use under the binomial system, but have rested in oblivion for a century and a half.

It has seemed desirable to call attention to this alternative suggestion at the present time because its merits can be most readily and satisfactorily investigated while botanists are testing the recently proposed rule to select types of Linnæan genera on the basis of the oldest reference.

O. F. COOK.

WASHINGTON,

February 3, 1903.

A GRANT FROM THE CARNEGIE INSTITUTION FOR
PALEOBOTANY.

THE executive committee of the Carnegie Institution has approved a grant of \$1,500 to G. R. Wieland, of the Yale University Museum, for the continuation during the year 1903 of his researches on the structure of the living and fossil cycads. In connection with this announcement the following brief statement is appended concerning the extent and progress of cycad investigation:

The cycadaceous nature of certain silicified stems with leaves and fruits unknown, from the English Wealden, was recognized as early as 1825. Nearly fifty years later Carruthers studied a similar remarkably preserved trunk from the Lower Greensand of the Isle of Wight, in which he discovered between the old leaf bases, which were thickly covered by ramental hairs like those of ferns, wonderfully preserved and nearly mature ovulate strobili of entirely different structure from those of any cycads known.

About this same time Williamson described certain cycadean leaf imprints as found associated with trunks and various casts of fruits of puzzling character from the cliffs of Hawkser and Runswick on the south coast of England. Nevertheless, these plants remained one of the most interesting of all paleobotanical riddles for the next thirty years, our knowledge of them being confined to their trunk structure and the ovulate strobilus, though it should be mentioned that Capellini and Solms found pollen grains in an imperfectly preserved fruit borne on a trunk found at the ancient Etruscan Necropolis of Marzabotto, thus showing that whatever the character of the male fructification, it must have been borne laterally like the seed-bearing cones.

Although handsome specimens of these cycad, or Bennettitalean trunks were found in this country between Baltimore and Washington as early as 1851, they were not observed to present any new structural details, and remained, as in Europe, among the rarest of fossils until the discovery in quick succession some ten years ago of numerous additional Maryland specimens, and the first of the highly important new localities in the Black Hills and Wyoming. At this time superb trunks from the Black Hills were obtained by the Smithsonian Institution, while still others of importance were collected by Professor Macbride, of the Museum of the State University of Iowa. In the meantime Professor Marsh became deeply interested, and with remarkable foresight and success secured for the Museum of Yale University the most extensive and valuable of all cycad collections. Yet another interesting series of trunks is that from central Wyoming belonging to the State University at Laramie.

The macroscopic study of the American material has been carried on by Professor Lester F. Ward, and its structural investigation by the writer.

The preliminary studies of the latter thus far published include in part the discovery of the leaves with their structure and prefoliation, additional facts concerning ovulate fructification, and, of most importance, the form, prefloration and principal structures of the bisporangiate strobili. These, like the ovulate cones, owe their marvelously perfect preservation, in large measure, to their protected position among the old leaf bases. They are found unexpanded, but quite mature and complete in every detail. Moreover, the features present indicate with exactness the appearance that must have been presented in life by the strikingly handsome expanded flower or strobilus, which was in some species nearly, or even one foot in diameter.

The microsporophylls, or staminate fronds, bear pollen in sori of a structure identically comparable with those of the tree ferns of the genus *Marattia*, and are the first of their type yet discovered. Their interest from an evolutionary point of view is, therefore, very

great, furnishing as they do the most direct evidence yet brought to light of the derivation of the Gymnosperms from ancient Marattiacean Pteridophytes bearing asexual spores. But, at the same time, the plan and other characters of the entire strobilus suggest much as to the possible manner and method of the evolution of the Angiosperms. In addition, these studies have already brought about a better understanding of the true character of various related but hitherto problematical fossil casts and impressions.

G. R. WIELAND.

YALE UNIVERSITY MUSEUM,
February 5, 1903.

CURRENT NOTES ON METEOROLOGY.

SCIENTIFIC INVESTIGATIONS BY WEATHER BUREAU MEN.

ONE of the most noticeable, and one of the most satisfactory, signs of the development of the United States Weather Bureau is the steady increase in the amount, and the no less steady improvement in the quality, of the original scientific investigations carried on by the rank and file of the Weather Bureau officials and observers. This encouraging advance is due largely to the energy and enthusiasm of the present Chief of the Weather Bureau, and of the more prominent officials of the service, notably Professors Abbe, Bigelow, Marvin, Henry and others. The two annual 'Conventions of Weather Bureau Officials' have doubtless also helped much towards this same end, for at these meetings there is opportunity for the reading of papers, for discussions, and for the promotion of a feeling of fellowship and of a spirit of scientific ambition which are most desirable. The *Proceedings* of the second annual convention of the officials of the Weather Bureau (Bulletin No. 31) is a volume containing a large amount of information of interest to every one who is working along meteorological lines, but the most striking feature of it, in the mind of the present writer, is the evidence it gives of original investigations carried on by Weather Bureau men. Space forbids any attempt at a review of this 'Bulletin.' Indeed, a mere enumeration of the titles of the papers read

at the Convention would occupy a column or two of SCIENCE.

CYCLES OF PRECIPITATION IN THE UNITED STATES.

IN the *Monthly Weather Review* for October, Mr. L. H. Murdoch, Section Director of the Weather Bureau at Salt Lake City, considers the cycles of precipitation at that station and at other places. He finds for Salt Lake City a dry cycle between 1827 and 1864, during which the average annual rainfall was about 15 inches; a wet cycle from 1865 to 1886, with an average annual precipitation of 18.42 inches, and from 1887 to the present time a dry cycle, the average annual precipitation from 1887 to 1901 being 15 inches. From the records for San Francisco, Sacramento, Denver, Omaha, St. Louis, Cincinnati and Baltimore it appears that the country west of the Rocky Mountains had its wettest cycle from 1866 to 1887, while the middle Mississippi and Ohio valleys received their heaviest precipitation from 1840 to 1859. The present dry cycle is general from San Francisco to Baltimore. Mr. Murdoch finds no relation between his rainfall curves and Wolfer's sunspot tables, and concludes 'that there is no known natural law by which we can predict the length of the present dry cycle.'

The rainfalls for certain stations in the United States, it may be recalled, have lately been studied by Brückner, who finds that they correspond very well with his thirty-five-year climatic period. Mr. Murdoch makes no reference to Brückner's work along these lines.

R. DEC. WARD.

CURRENT NOTES ON PHYSIOGRAPHY.

ABANDONED CHANNELS OF THE MONONGAHELA.

THE Masontown-Uniontown folio of the Geologic Atlas of the United States by Campbell describes a part of the Alleghany plateau in southwestern Pennsylvania. The higher plateau, east of Chestnut-Laurel ridge, is referred with some doubt to a much wasted stage of the uplifted Cretaceous peneplain of the Appalachian province; the lower uplands, further west, represent an Eocene peneplain, now maturely dissected. The chief river is the Monongahela, whose curving valley had

been already well graded and opened by early glacial times; since then the river has cut a narrow trench 150 feet below its former valley floor. The trench is still so young that only slender discontinuous strips of flood plain are developed along it, on the inner side of curves; while the larger side streams enter the main valley with a strong slope, and still preserve the open flood plains of the earlier cycle in their middle course. But the most peculiar features of the district are the abandoned channels of the Monongahela at the level of the open valley floor. These are not normally cut-off, round-about channels, like those of the Meuse and Moselle, abandoned by wearing through the necks of the spurs that the river once contoured; for the new courses of the Monongahela are cut through broad, stout spurs for distances of a mile or more. Moreover, the abandoned channels are much clogged with silt, sand and gravel, with some boulders, to depths of 100 feet. Features of this kind are known in connection with several other north-flowing rivers not far south of the glaciated area, the most noted example being the heavily silted Teay valley, from which the Kanawha has turned northward to the Ohio. Campbell suggests that the new courses were taken when the old valleys were locally obstructed at various points by ice dams during the Kansan glacial epoch; each dam is supposed to have gained such strength that it endured for many years, and such height that it surmounted the level of some saddle among the hills on one or the other side of the main valley. Then silts and gravels were deposited in the ponded part of the river, while the new channel was incised in the saddle of overflow. The uplift by which the deepening of the new valleys below the older ones was brought about is dated as post-Kansan.

The hypothesis of local ice-dams, begun during the spring floods of frozen rivers and strengthened on account of the more severe climate of the early glacial epoch, seems at first reading hazardous from the number, height and duration of the dams required. The number of examples is, however, more in favor of the hypothesis than against it: if

the accident happened once, it might become a common occurrence. The height of the dams is in excess of examples ordinarily reported, but not vastly in excess. The duration needed for the dams is of difficult acceptance. On the other hand, the hypothesis is carefully studied out; it is literally a working hypothesis, in the sense that it will account for the observed facts. The alternative hypothesis of laked rivers, obstructed in their northward flow by the ice sheet itself, is of difficult application, in that it does not clearly lead to the desertion of old valleys, unless on the improbable supposition that the lakes were filled by silting and the silts were afterwards in great part removed.

LA CÔTE D'OR.

THE headwaters of the Seine and Yonne flow northwest through valleys well entrenched in the calcareous plateau of Langres, in the east-central part of France, whose surface at altitudes of 400 or 500 meters expresses the structure of the region. The Saône flows southward on the broad, aggraded plain of la Bresse at altitudes near 200 meters. Between the two is a dissected escarpment, determined by a fault with downthrow of several hundred meters on the southeast, whose sunny slopes or *côtes* have given name to the department, within the ancient province of Burgundy, of which Dijon is the chief city. Girardin describes the features of this interesting district: 'Le relief des environs de Dijon et les principales formes topographiques de la Bourgogne' (*Ann. de Géogr.*, XI., 1902, 43-53). The several elements of form are taken up in succession and explained in their relation to geological structure, as well as to human occupation. The isolated areas of upland, 'la montagne,' are dry, relatively barren, with few and poor inhabitants, whose number is decreasing. Residual mounds, 'hauteaux, montots, tasselots,' the remnants of once overlying strata, surmount the uplands. The slope, 'la côte,' strewn with stony waste from the rimming bluffs of the 'montagne,' is occupied with vineyards where well exposed to sunshine. Ravines or 'combes' and valleys, frequently

with large springs at the stream heads, are gnawing into the uplands from the low plain on the southeast, threatening the headwaters of the Seine system.

The subject of this essay invites fuller treatment in several directions. The development of topographic features in relation to time might be presented to advantage in greater detail: thus a better understanding could be gained of the effects of faulting on form, and of the relation of the montots to the combes. All of the elements of form could be better appreciated by the foreign reader if they were more explicitly related to the type examples of systematic physiography, so that each local instance should be presented as a variant upon a standard of its kind. Finally, several large problems invite attention in this district: What effect had the depression of the Saône basin on the headwaters of the Seine system? At what stage in the development of the valleys of the Seine system did the Saône depression take place? What changes have taken place since the depression occurred? Perhaps the French geologists are in a position to answer these physiographic questions, but the answers have not yet been given by French geographers.

CAÑONS OF THE EUPHRATES.

THE narrative of a trip 'Through the Great Cañon of the Euphrates River' on a skin raft, by E. Huntington (*Geogr. Journ.*, XX., 1902, 175-200), includes a graphic account of a number of physiographic features. The stretch of 190 miles along the river included something more than the great northwest bend within which Harput is situated. The journey occupied seven days, although only thirty-seven hours were spent in floating down the river. The region includes many subparallel ranges, trending northeast-southwest, and enclosing as many waste-floored basins. In the basins, the river is incised but little below the basin plain, its channel sometimes forming a braided network on an open flood plain with a fall of only two feet a mile. In the mountains the river follows narrow cañons, from 2,000 to 5,000 feet deep, with steep walls and no flood plain; here the channel is

often roughened with ungraded ledges or half barred with the fans of lateral torrents, and the fall rises to sixteen feet a mile. All these features point to a relatively recent deformation of the country, in consequence of which the river has aggraded the depressed basins and trenched the uplifted ranges. It is noted that only the smaller side streams cascade into the cañon; the larger ones have cut down their lateral ravines to grade with the main river. The analogy of the Euphrates and the Colorado in this respect is pointed out. The stationary condition of the native population is remarkable; the navigation of the river is still in the most primitive condition; an altar was seen 'covered with the gore of the scores of sheep and goats, which are brought as sacrifices by both Christians and Mohammedans'; irrigation is very poorly developed. The people could not understand the motive of the 'men with hats' in making so venturesome a journey down the river. A characteristic comment was: "They say they are not paid for making this journey, but we know better. * * * They know everything; they see a stone or a plant, a brook or a mountain, and they know it. * * * They write everything." A more general article by the same author, on 'The Valley of the Upper Euphrates River and its People,' has lately appeared in the *Bulletin of the American Geographical Society*.

W. M. DAVIS.

RECENT ZOOPALEONTOLOGY.

AGE OF THE TYPICAL JUDITH RIVER BEDS.

REFERRING to the recent communication of Mr. J. B. Hatcher and Professor S. W. Williston, on the subject of the age of the Judith River Beds, Mr. Hatcher remarks: 'I do not know upon what authority Professor Osborn makes this unqualified statement as to the deposits underlying the Judith River Beds.' I would say that the authorities for the Upper Cretaceous (and hence overlying) position of the Judith River Beds are partly cited in my recent memoir on 'The Vertebrata of the Mid-Cretaceous of the Northwest Territory,' namely, Cope ('Geology of the Judith River Basin,' 1876-7) and Cross ('Geology of the

Denver Basin'). In his Cretaceous Correlation papers (U. S. Geol. Surv., 1891) C. A. White clearly refers the Judith River Beds to the Upper Cretaceous (pp. 145, 147); furthermore, the references which he makes to the Mid-Cretaceous Belly River deposits do not include any allusion to the typical Judith River, and distinctly state (p. 166) that the equivalent of these Belly River is not recognized in Montana. I thought I had, therefore, abundant authority for the statement, 'among geologists of the United States there has never been any question as to the Laramie or Upper Cretaceous age of the typical Judith River Beds.' I had received from Mr. Hatcher, but unfortunately had quite overlooked, his paper in which the Mid-Cretaceous age of the Judith River was first suggested. Otherwise due acknowledgment would have been made. In the last edition of his 'Geology,' published in 1895, and after complete review of the literature, Dana refers to the Judith River Beds as Upper Cretaceous, equivalent to the Laramie. It would be difficult to find higher authorities than these, and it is impossible, in the preparation of a memoir, to trace back every single statement to its original source; we must accept some authority, otherwise every statement requires a prolonged piece of original investigation.

Mr. Hatcher has done decided service in calling attention to the fact that in the original description of the *typical locality* Meek and Hayden left the actual relation of the Judith River Beds undetermined. Naturally it is this typical locality to which we must turn. It is, therefore, in view also of Professor Williston's communication, of the utmost importance that the vertebrate horizons of the Cretaceous should be thoroughly restudied. All critical notices and observations on this important geological problem are most welcome.

The following communication of this nature has been received from Mr. Sternberg, under date of December 11:

"I have been reading in SCIENCE Mr. J. B. Hatcher's correction of your statement in regard to the Fort Pierre and Fox Hills Groups, underlying the 'true Judith River Beds,' and

asking where you get the authority to make such a statement. I suppose Mr. Hatcher has never visited Dog Creek near the mouth of the Judith River, or read Professor Cope's paper on the Judith River region, with a cut illustrating this valley of Dog Creek. I was with the Professor when he made the sketch from which the illustration was made. I also know that the great bed of black shale filled with beds of soft coal was called Fort Pierre by Professor Cope, and that I found several bones of Mosasaurs in it resembling *Platecarpus*, that the buff-colored sandstone on top was called Fox Hills by Professor Cope. On top of these formations were the Judith River Beds, in which we found great numbers of the cast-off teeth of Dinosaurs. I there found the new ray *Myledaphus bipartitus* Cope, and many fragmentary shells of *Trionyx*, etc. On top of all was a bed of oysters. We got no complete bones, I believe, here of Dinosaurs. The two new species I found of *Monoclonius* were near Cow Island, about fifty miles down the river. I write for information. Is not Mr. Hatcher wrong in his correction? We found no Mosasaur bones in the vicinity of Cow Island. Would not the finding of these animals at Dog Creek prove the Fort Pierre age? We have similar deposits on top of the Niobrara in western Kansas that contain many Mosasaurs."

HENRY F. OSBORN.

A NEW DIVISION OF THE UNITED STATES GEOLOGICAL SURVEY.

A NEW division, to be known as the Division of Hydrology, has recently been organized by the Hydrographic Branch of the United States Geological Survey. The work of the division will include the gathering and filing of well records of all kinds, the study of artesian and other problems relating to underground waters, and to the investigation of the stratigraphy of the water-bearing and associated rocks. In addition to the gathering of statistics relating to the flow, cost, etc., of the wells, it is hoped in the future to give especial attention to the geological features

which govern, or which are related in any way to, the supply of water.

The division will be subdivided into two sections, the eastern and the western, the first embracing the Gulf and Mississippi River states and the states to the east, and the second embracing the remaining ('reclamation') states and territories, or those having public lands. The charge of each section has been assigned to a geologist, the western section to Mr. N. H. Darton and the eastern section to Mr. M. L. Fuller. The office details are in charge of Mr. Fuller.

The sections will be still further subdivided, each state, or group of adjacent states, constituting a district, in which the work of collecting data and of the investigation of the problems relating to underground water will be in charge of a geologist employed for the purpose.

In the western section it is expected that the study of the geological structure will be followed by the sinking of wells by the survey, the aim being to test such of the arid or semi-arid regions as appear to present conditions favorable for artesian water, with a view to their ultimate development for agricultural purposes.

SCIENTIFIC NOTES AND NEWS.

DR. L. EMMETT HOLT, secretary of the board of directors of the Rockefeller Institute for Medical Research, has made a statement in regard to its plans. In addition to the \$200,000 given by Mr. J. D. Rockefeller in 1901 for current uses, he has now given \$1,000,000 for land and buildings, and it is understood that he is prepared to contribute such additional means as the needs of the institution demand. Dr. Simon Flexner, professor of pathology at the University of Pennsylvania has been elected director of the laboratory.

It is reported in the daily papers that Mr. Marshall Field has offered to erect a museum on the Lake Front Park, Chicago, which may cost as much as \$10,000,000.

A BILL has been introduced at Albany at the request of the State Commissioner of Lunacy, appropriating \$300,000 for the con-

struction of a psychopathic hospital in New York city.

At the Founder's Day celebration of the University of Pennsylvania, the degree of D.Sc. was conferred on President Alex. C. Humphreys, of Stevens Institute of Technology. The address was made by Dr. S. Weir Mitchell.

DR. E. A. KENNELLY, of Harvard University, lectured on February 18 before the New York Electrical Society on the laying of the cable across the Gulf of Mexico.

PROFESSOR CHARLES A. DOREMUS, of the City College, New York city, lectured at the college on February 21 on the life and scientific work of Robert Bunsen. The lecture was given under the auspices of the Cooper Union Chemical Society.

JOHN H. BARR, professor of machine design at Cornell University, is to become manager of the Smith Premier typewriter works at Syracuse.

THE Executive Committee of the Illinois Wesleyan has granted Professor J. Culver Hartzell eighteen months leave of absence to pursue his investigation on conditions of fossilization in Germany. He sails from New York on March 18.

REUTER'S agency states that Dr. Sven Hedin, the Swedish explorer, delivered a lecture on February 7, to the Geographical Society of Berlin upon his recent journeys in Central Asia and Tibet. During his lecture Dr. Sven Hedin gave some description of the Chinese writings he had discovered in a ruined city on the shores of Lake Lak-nor. The sinologist, Dr. Himle, of Wiesbaden, to whom they had been sent for translation, was of opinion that they pointed to the existence of a flourishing Chinese community about A. D. 250 on the spot marked by these ruins. At the conclusion of the lecture Professor Hillman announced that the German Emperor had conferred on Dr. Sven Hedin the second class with the star of the Prussian Order of the Crown. Dr. Sven Hedin was elected an honorary member of the Berlin Geographical Society, and was presented with the golden

'Nachtigal' medal which was founded in memory of a well-known Central African explorer.

DR. GEORGE B. SHATTUCK, professor of physiographic geology of the Johns Hopkins University, and secretary of the Baltimore geographical Society, has been authorized by the directors to organize an expedition for a systematic scientific survey of the Bahama Islands.

DR. F. B. LOOMIS, of Amherst College, will this summer conduct an expedition for the collection of fossils to the Bad Lands of South Dakota.

THE Imperial Academy of Science of St. Petersburg will send an expedition to search for Baron Toll, who is exploring the Siberian coast line, and who was reported on November 21 to have been cut off from the coast by early winter ice in New Siberia. Lieut. Koltchak, who was with Baron Toll will command the expedition.

THE Field Columbian Museum, Chicago, has arranged a course of lectures on science and travel for Saturday afternoons at three o'clock, as follows:

March 7—'The Crow Indians of Montana,' Mr. S. C. Simms, Assistant Curator, Division of Ethnology.

March 14—'Diamonds and Diamond Mining,' Professor O. C. Farrington, Curator, Department of Geology.

March 21—'The English Sparrow,' Dr. J. Rollin Slonaker, University of Chicago.

March 28—'A Tour of the Plant World—Japan,' Dr. C. F. Millspaugh, Curator, Department of Botany.

April 4—'Swimming Reptiles,' Dr. S. W. Williston, Associate Curator, Division of Paleontology.

April 11—'Mining in the Southern Appalachians,' Mr. Henry W. Nichols, Assistant Curator, Department of Geology.

April 18—'Our Household Insects,' Mr. W. J. Gerhard, Assistant Curator, Division of Entomology.

April 25—'Experimental Agriculture in Russia,' Mr. Frederick W. Taylor, Chief of the Department of Agriculture, St. Louis Exposition, 1904.

THE medical papers of Ithaca state that the epidemic of typhoid fever at Ithaca has resulted in the death of ten students of Cornell University. Ten professors and instruct-

ors are ill with the fever. The epidemic is, however, now abating.

A CIVIL service examination will be held on March 10 for the position of aid in the Division of Mollusks, U. S. National Museum, with a salary of \$1,000. On April 7 and 8 there will be an examination to fill positions as hydrographic aid in the U. S. Geological Survey, at salaries of \$65 and \$70 a month. It is stated that these appointees will be eligible for future promotion as assistant engineer after one or two years' service in the field.

WE learn from the *Electrical World* that at a meeting of the Fritz Memorial Committee, held in New York on January 23, the announcement was made that the four national engineering societies have appointed the following as their representatives on the board of trustees of the Fritz Medal: American Society of Civil Engineers, J. James R. Croes, New York, one-year term; Robert Moore, two-year term; Alfred Noble, New York, three-year term; Charles Warren Hunt, New York, four-year term. American Institute of Mining Engineers, E. E. Olcott, New York, one-year term; E. G. Spilsbury, New York, two-year term; James Douglas, New York, three-year term; Charles Kirchhoff, New York, four-year term. American Society of Mechanical Engineers, Gaetano Lanza, Boston, Mass., one-year term; John E. Sweet, Syracuse, N. Y., two-year term; Robert W. Hunt, Chicago, Ill., three-year term; S. T. Wellman, Cleveland, Ohio, four-year term. American Institute of Electrical Engineers, Arthur E. Kennelly, Cambridge, Mass., one-year term; Carl Hering, Philadelphia, Pa., two-year term; Charles P. Steinmetz, Schenectady, three-year term; Charles F. Scott, Pittsburgh, Pa., four-year term.

COMMANDER W. H. H. SOUTHERLAND, head of the Hydrographic Office of the Navy Department, contributes to the *National Geographic Magazine* for February an article defining the work of this great geographic bureau. At the present time the Hydrographic Office has in its possession nearly 1,200 engraved chart plates and about 50

photographic chart plates. These 1,250 plates have all been constructed from the results of original naval surveys; from geographical and cartographical data reported by the commanding officers of vessels in the naval service; from information collected by the branch hydrographic offices from incoming mariners of all nationalities, and also from the geographical information that comes into the custody of the Navy Department through the prosecution of surveys by foreign governments. These charts represent about one-third of what are actually necessary for a complete set of navigational charts of the world for the use of the naval and shipping interests of the United States. It must not be understood, however, that if we were to become possessed of engraved plates representing the charts now issued by all other nations we would be able to produce navigational charts covering the world's entire water area. Very much remains to be done before the hydrographic features of the world can be so chartered as to warrant the statement that dangers to navigation due to lack of knowledge of geographic positions and correct soundings have been reduced to a minimum. There are numerous places in the West Indies which we know to be inaccurately charted, and this same statement applies to locations in nearly all parts of the world. In the North Pacific Ocean alone there are thousands of reported dangers. Many of these are probably either inaccurately located or do not exist, but all the same they are a hindrance to navigation through the anxiety or loss of time which the fear of their possible existence causes to shipmasters. Fortunately, little by little the national vessels of the Great Powers are either accurately locating or disproving the existence of many of these.

As a result of an investigation along the Colorado River, made in January, 1902, by the hydrographic branch of the United States Geological Survey, the extent of the alluvial bottom land between Camp Mohave and Yuma was found to be from 400,000 to 500,000 acres. Extended surveys were begun November 1, last, to determine the area and quality of these

bottom lands, the possibility of diverting water to them, and the probable expense of their reclamation. The average rainfall at Camp Mohave is only 5.99 inches per annum, and at Yuma it is 3.06 inches per annum, while the temperatures are such as to provide twelve growing months in the year. The Colorado River derives its principal source of water supply from the melting snow on the high mountains of Utah, Colorado and Wyoming. It reaches the stage of maximum flow—approximately 50,000 cubic feet per second—in the months of May and June, when the demand for irrigation is normally the highest; its minimum flow—about 4,000 cubic feet per second—occurs in the months of January and February, at the time of least demand. The opportunities for storage on this stream are very great. The silts of the river are difficult to handle in canals, but the fertilizing properties which they have are such that lands irrigated with these muddy waters will never require further fertilization. Mr. R. H. Forbes, of the Agricultural Experiment Station at Tucson, Ariz., who has made a study of the silt in the Colorado River, has pointed out that this stream resembles the Nile in many particulars. Like the great river of Egypt, the Colorado is subject to an annual summer rise sufficient to overflow the extensive areas of its borders and delta lands. These high waters are rich in fertilizing sediments, are exceptionally free from alkaline salts, and come at an opportune time for irrigation. Mr. Forbes maintains that when the Colorado is understood and utilized as successfully as the greater and better-known Egyptian stream, it will be recognized as the American Nile—the creator of a new country for the irrigator, the mother of an occidental Egypt.

UNIVERSITY AND EDUCATIONAL NEWS.

By the will of the late Professor Sylvester Waterhouse, of St. Louis, Washington University received \$25,000, and Harvard University and Dartmouth College each \$5,000. The bequest to Washington University is to accumulate until the year 2000.

SIR WILLIAM MACDONALD, of Montreal, has donated a further sum of \$4,500 to the Macdonald Institute at the Ontario Agricultural College, Guelph, to complete the furnishing. This makes a total of \$175,000 given by Sir William to this institute.

S. M. INMAN, of Atlanta, Ga., has given \$25,000 toward the proposed presbyterian university to be erected in that city.

THE new library building given to Trinity College at Durham, N. C., by Mr. James E. Duke, was formally opened on February 23. The dedicatory address was given by Mr. Walter H. Page of New York.

THE Association of the Colleges and Preparatory Schools of the Middle States and Maryland will hold its next annual meeting at Columbia University, November 27 and 28.

At the mid-winter commencement of the University of Nebraska, on February 16, 1903, degrees were conferred as follows: Bachelors of Arts, 17; Bachelors of Science, 7; Doctor of Medicine, 1; Master of Arts, 1; Doctor of Philosophy, 1. Eleven graduates were given University Teachers' certificates. The thesis presented by the candidate for the degree of Doctor of Philosophy, Haven Metcalf, was in botany, and consisted of a discussion of the cause and nature of a disease of sugar-beets, to which the name of 'sour rot' has been applied.

THE chair of physiology at the Harvard Medical School, occupied by Professor H. P. Bowditch, will hereafter be known as the George Higginson Professorship.

DR. GEORGE B. HALSTED, late of the University of Texas, has been elected to the chair of mathematics of St. John's College, Annapolis, Md., to succeed Professor John L. Chew.

DR. ALEXANDER JOHNSON, dean of the faculty of arts and professor of pure mathematics, and the Rev. Dr. J. Clark Murray, professor of mental and moral philosophy, have resigned their appointments at McGill University, to take effect September 1, 1903. They retire in accordance with the pension scheme formulated last year by the board of governors.